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MALCOLM PIRNIE, INC

Inter-Office Correspondence

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To: R.P. Brownell

Date: 8/4/82

From: J.B. Mulligan

Subject: Waukegan Harbor PCB Problem

As requested, we have prepared preliminary cost estimates for a number of alternative methods of reducing the potential for environmental danger from PCB contamination in the Waukegan Harbor area. The alternatives considered are subdivided into two groups: those affecting the north ditch and parking lot and those affecting the harbor. In some instances, however, combined north ditch - harbor solutions have been considered. In these instances, a share of the costs of facilities which would be used jointly has been assigned to both the north ditch and harbor projects in accordance with the ratios of the volumes of contaminated materials removed from each location.

The various alternatives considered are as follows:

North Ditch and Parking Lot Alternatives

A-1 No action - monitor long term losses of PCB's to environment only.

A-2 Construct a new storm drain to divert water from the north ditch; fill in ditch with clean material obtained from off-site sources to prevent PCB losses through erosion of ditch sediments and volatilization.

A-3a-1
A-3a-2
A-3a-3 Remove selected, highly contaminated material from the north ditch and parking lot and dispose of in containment site to be constructed on OMC's vacant lot; fill in remainder of ditch and excavated areas with clean material. The containment site would also be used for disposal of material dredged from Slip 3 and the upper harbor under Alternatives B-3a, B-3b and B-3c.

A-3b Remove selected, highly contaminated material from the north ditch and parking lot and dispose of in a containment site constructed by sealing off Slip 3. Fill in remainder of ditch and excavated areas with clean material. Contaminated material in the upper harbor outside of Slip 3 would be dredged and placed in the containment site under Alternative B-2a.

A-4 Remove 50 ppm and greater contaminated material from the north ditch and parking lot and dispose of in a secure containment site constructed in the parking lot. The containment site would also be used for disposal of material dredged from the harbor under Alternative B-4.

DEPOSITION EXHIBIT
BROWNELL-OMC
3-TD 8.10.84

A-5 Remove 50 ppm and greater contaminated material from the north ditch and parking lot and dispose of in secure containment site to be constructed at a site to be selected with 20+ miles of Waukegan Harbor. This containment site would also be used for disposal of dredged material from the harbor under Alternative B-5.

Harbor Alternatives

B-1 No action - monitor long term losses of PCB's to environment only.

B-2a Convert Slip 3 into a containment site; fill with material dredged from upper harbor outside of Slip 3. This containment site would also be used for disposal of material removed from the ditch and parking lot under Alternative A-3b.

B-2b Convert Slip 3 into a containment site, dredge 50 ppm contaminated material from upper harbor and dispose of in slip.

B-3a Dredge Slip 3 and approximately 500 c.y. of selected, highly contaminated material near mouth of Slip 3 and dispose of in secure containment site constructed on OMC's vacant lot. Selected, highly contaminated material from the north ditch and parking lot would also be placed in this containment site under Alternative A-3a.

B-3b Same as Alternative B-3c but remove 20,000 c.y. from upper harbor outside of Slip 3. Material from the north ditch and parking lot would also be placed in this containment site under Alternative A-3a-2.

B-3c Dredge Slip 3 and upper harbor and dispose in containment site on OMC's vacant lot. This containment site would also be used to dispose of selected, highly contaminated material removed from the north ditch and parking lot under Alternative A-3a-3.

B-4 Dredge Slip 3 and upper harbor and dispose of in containment site on OMC's parking lot. The containment site would also be used for disposal of material removed from the north ditch and parking lot under Alternative A-4.

B-5 Dredge Slip 3 and upper harbor and dispose in a secure containment site to be constructed within 20+ miles of Waukegan Harbor. This containment site would also be used for the disposal of material removed from the north ditch and parking lot under Alternative A-5.

B-6 Dredge Slip 3 and approximately 500 C.Y. of selected, highly contaminated material near the mouth of the slip and dispose of in a secure containment site on OMC's vacant lot.

JBM:mhn:mrw

ALTERNATIVE A-1

NORTH DITCH AND PARKING LOT AREA - NO ACTION

Under Alternative A-1, the only action which would be taken would consist of the installation of ground water monitoring wells, a permanent gaging and sampling station on the North Ditch, and an air monitoring station. The six existing monitoring wells would be sampled periodically, if still available, and two new nested well systems consisting of three wells each would be constructed near the easterly end of the ditch.

Estimates of capital costs and annual sampling and maintenance costs are presented below.

ESTIMATED CAPITAL COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Monitoring wells	2 Nests of 3 EA.	$ 8,000.00	$ 16,000
Purchase Flow meter and remote chart recorder	1 EA.	2,500.00	2,500
Purchase automatic water sampler	1 EA.	4,000.00	4,000
Purchase automatic air sampler	1 EA.	8,000.00	8,000
Construct small building	100 S.F.	30.00	3,000
Install Electrical Power	L.S.	L.S.	3,000
Construct concrete weir	L.S.	L.S.	4,000
Install equipment in building	L.S.	L.S.	3,000
TOTAL ESTIMATED CONSTRUCTION COST			$ 43,500
Contingencies @ 20%			8,700
Engineering, Legal & Administrative @ 28%			12,180
TOTAL CAPITAL COST			$ 64,380

ESTIMATED ANNUAL O&M COSTS

Equipment maintenance and Electric Power Charges	L.S.	L.S.	2,500
Ground Water Sampling and analysis	24 Samples	210.00	5,040
Air sampling and analysis	4 Samples/Yr.	400.00	1,500
Surface water sampling and analysis	6 Samples/Yr.	220.00	1,320
Annual reports & misc. paper work	L.S.	L.S.	5,000
TOTAL ESTIMATED ANNUAL COST			$ 15,460

ALTERNATIVE B-1

HARBOR AREA - NO ACTION

Under Alternative B-1, the only action which would be taken would consist of the installation of ground water monitoring wells around the harbor, flow recording and sampling equipment in the harbor entrance and a permanent air monitoring station.

The ground water monitoring wells would consist of four nests of two wells each. Each well would be sampled four (4) times per year.

The flow recording and sampling station in the harbor entrance would be run continuously for the first year to develop background data. Thereafter, sampling and flow measurements would be done on a quarterly basis.

Estimates of capital costs and annual operation and maintenance costs are presented below.

ESTIMATED CAPITAL COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Monitoring wells	4 nests of 2 EA.	$ 5,500.00	$ 22,000
Purchase & Install Automatic Air Sampler	1 EA.	8,000.00	8,000
Install electric power to automatic equipment	L.S.	L.S.	3,000
TOTAL ESTIMATED CONSTRUCTION COST			$ 33,000
Contingencies @ 20%			6,600
Engineering, Legal & Administrative @ 28%			9,200
TOTAL ESTIMATED CAPITAL COST			$ 48,800

ESTIMATED ANNUAL O&M COSTS

FIRST YEAR COSTS	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric power charges	L.S.	L.S.	$ 2,000
Ground water sampling and analysis	16 Samples	$ 210.00	3,360
Air Sampling and Analysis	4 Samples	400.00	1,600
Continuous flow monitoring and sampling in harbor	L.S.	L.S.	125,000
Annual reports & Misc. paper work	L.S.	L.S.	5,000
TOTAL ESTIMATED FIRST YEAR COST			$ 136,960

ALTERNATIVE B-1 (continued)

SUBSEQUENT YEARS COSTS	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric power charges	L.S.	L.S.	$ 2,000
Ground Water Sampling and analysis	16 Samples/yr.	$ 210.00	3,360
Air Sampling and Analysis	4 Samples/yr.	400.00	1,600
Water samples from harbor	24 Samples/yr.	220.00	5,280
Annual report and misc. paper work	L.S.	L.S.	5,000
TOTAL ESTIMATED ANNUAL COST			$ 17,240

ALTERNATIVE A-2

Under Alternative A-2, a new storm drain would be constructed from the existing 36-inch diameter drain near the railroad to the lake to divert surface runoff and cooling water from the north ditch. The ditch would then be filled in and covered with a clay cap, topsoil and vegetative cover to prevent a catastrophic loss of PCB laden sediments to the lake. Monitoring wells would be constructed near the ditch on the easterly end of the parking lot and ground water monitoring would be carried out to determine the long term losses of PCBs via that route.

No action would be taken with respect to PCBs under the surface of the parking lot. However, contaminated material excavated during the construction of the new storm drain through the parking lot would be used to fill a portion of the crescent ditch.

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-2

STABILIZE NORTH DITCH

DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
Construct New Storm Drain			
New RCP Storm Drain	2,650 L.F.	$ 100.00	$ 265,000
Manholes 8-FT. dia. precast	9 ea.	5,000.00	45,000
Dewatering-well point	2,650 L.F.	20.00	53,000
Riprap at outlet	50 C.Y.	50.00	2,500
Disposal of Contaminated Exc. (in ditch)	2,000 C.Y.	5.00	10,000
Surface restoration over drain	8,000 S.Y.	9.00	72,000
Fill in Ditch, Crescent Ditch & Lagoon			
Backfill E-W portion of ditch	4,730 C.Y.	10.00	47,300
Backfill lagoon	1,060 C.Y.	10.00	10,600
Backfill Crescent ditch	1,400 C.Y.	10.00	14,000
1-FT. Clay Seal, topsoil & seed	6,000 S.Y.	6.00	36,000
Monitoring Wells	L.S.		10,000
TOTAL ESTIMATED CONSTRUCTION COST			$ 565,400
Contingencies @ 20%			113,080
Engineering @ 25%			141,350
Legal and Administrative @ 3%			16,962
TOTAL PROJECT COST			$ 836,792

ALTERNATIVE A-2

ESTIMATED ANNUAL O&M COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	6 Samples	$ 210.00	1,260
Air sampling and analysis	1 Sample	400.00	400
Annual inspection & Report	40 Hours	60.00	2,400
TOTAL ESTIMATED ANNUAL COSTS			$ 6,560

ALTERNATIVE A-2

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2.	Construct Storm Drain	76	107
3.	Restore Parking Lot over Drain	10)	16
3a.	Backfill Ditch	12)	
4.	Seal Surface of Ditch, Topsoil & Seed	8)	10
4a.	Install Monitoring Wells	3)	
5.	Demobilization	2	2
	TOTAL		156

ALTERNATIVES A-3a-1 AND B-3a

Under Alternative A-3a-1, a new drain would be constructed across the parking lot to divert water away from the north ditch, as in Alternative A-2, and approximately 10,100 C.Y. of the most highly contaminated material in the crescent ditch, oval lagoon and parking lot would be excavated and disposed of in a secure containment site constructed on OMC's vacant lot. Excavation would be accomplished by driving interlocked steel sheeting around small areas to be excavated, dewatering within the sheeted areas, and trucking the excavated material to the containment cell in a relatively dry state.

Under Alternative B-3a, approximately 10,875 C.Y. of material would be dredged from slip 3, together with an additional 500 C.Y. of sediment in the upper harbor near the mouth of slip 3 which will have to be removed to prevent loss of use of the harbor by Larsen Marine Co. This material would be pumped, as a slurry, to the containment site on OMC's vacant lot. The slurry water would be passed through a settling basin and returned to the area of the dredge. To insure that losses of PCB's to the lake were minimized during dredging, the area to be dredged would be sealed off through the installation of a temporary sheet pile wall. The water treatment plant would be dismantled and placed inside the containment cell upon completion of the dredging, and the cell dewatered thru a carbon filter to remove high levels of PCBs.

The capacity of the containment cell was determined as follows:

Material to be dredged from Harbor	11,375 C.Y.
Allowance for Water Treatment Plant disposal	5,500 C.Y.
Material to be excavated from north ditch	10,100 C.Y.
Contaminated material from storm drain construction	2,000 C.Y.
SUBTOTAL	28,975 C.Y.
Allowance for expansion of material 20%	5,800 C.Y.
TOTAL	34,775 C.Y.
SAY	35,000 C.Y.

An additional two (2) feet of freeboard was allowed in determining the height of the berms surrounding the cell. The area would be filled with the remainder of the material used for the construction of the water treatment plant.

Cost estimates for Alternatives A-3a-1 and B-3a are presented in the attached tables. In preparing these estimates, each Alternative was assigned a share of the "common" cost of the disposal site. It should be noted, however, that if only one of the Alternatives were to be built, the disposal site costs would be entirely different from those shown.

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-3a-1

Remove Selected Highly Contaminated Material from the North Ditch and Parking Lot and Dispose of in Containment Site on OMC's Vacant Lot.

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Storm Drain			
New RCP storm drain	2,650 L.F.	$ 100.00	$ 265.000
Manholes 8' dia. precast	9 EACH	5,000.00	45,000
Dewatering - well point	2,650 L.F.	20.00	53,000
Rip rap at outlet	50 C.Y.	50.00	2,500
Disposal of contaminated excavation in containment site	2,000 C.Y.	5.00	10,000
Surface restoration over drain	8,000 S.Y.	9.00	72,000
Excavate Contaminated Material From Ditch and Parking Lot			
Relocate utilities - sewers, etc.	L.S.	L.S.	20,000
Temporary sheeting	36,000 S.F.	8.00	288,000
Well point dewatering	L.S.	L.S.	60,000
Excavation and hauling to containment site	10,100 C.Y.	10.00	101,000
Backfill excavated areas	10,100 C.Y.	10.00	101,000
Backfill original ditch (see Alternative A-2)	7,190 C.Y.	10.00	71,900
1' clay seal, topsoil and seed ditch	6,000 S.Y.	6.00	36,000
Restore parking lot excavations	700 S.Y.	7.00	4,900
Decontaminate equipment	L.S.	L.S.	20,000
Air monitoring during excavation	L.S.	L.S.	5,000
SUBTOTAL CONSTRUCTION COST:			$1,155,000
Ditch and Parking Lot Share of Cost of Containment Site on OMC's Vacant Lot (see estimate attached)			369,482
TOTAL CONSTRUCTION COST:			$1,524,482
Contingencies @ 20%			304,896
Engineering @ 25%			381,120
Legal and Administrative @ 3%			45,734
TOTAL PROJECT COST:			$2,256,232

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-3a

DREDGE SLIP 3 AND UPPER HARBOR AND DISPOSE OF IN CONTAINMENT SITE ON OMC'S VACANT LOT

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Upper Harbor & Slip 3			
Dredging	11,375 C.Y.	$ 10.00	$ 113,750
Temporary sheet pile wall for closing harbor	9,000 S.F.	8.10	72,900
Reinforce existing sheet pile wall	3,900 S.F.	16.55	64,545
Chemicals & labor for water treatment	L.S.	L.S.	12,000
Miscellaneous water treatment equipment	L.S.	L.S.	30,000
Air & Water Monitoring During Dredging	L.S.	L.S.	25,000
Decontamination of Equipment	L.S.	L.S.	25,000
Construct Water Treatment Plant			
Sand Berms	11,000 C.Y.	6.00	66,000
Synthetic liner	50,000 S.F.	0.85	42,500
Gravel blanket	2,000 C.Y.	10.00	20,000
Overflow weir & piping	L.S.	L.S.	25,000
Static mixer, chemical feed pumps, etc.	L.S.	L.S.	30,000
Dismantle & place in containment cell @ closure	L.S.	L.S.	30,000
Dewatering Containment Cell Prior to Placing Final Cover	L.S.	L.S.	50,000
SUBTOTAL CONSTRUCTION COST			$ 606,695
Share of Containment Site Cost for Dredging (See Attached Estimate)	L.S.	L.S.	531,693
TOTAL CONSTRUCTION COST			$1,138,388
Contingencies @ 20%			227,678
Engineering @ 25%			284,597
Legal & Administrative @ 3%			34,152
TOTAL CONSTRUCTION COST			$1,684,815

PRELIMINARY COST ESTIMATE

CONTAINMENT SITE ON OMC'S VACANT LOT
USE WITH ALTERNATIVES B-3a AND A-3a-1
(Construct Containment Site for 35,000 c.y.)

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Level and compact site	L.S.	L.S.	$ 35,000
1' clay blanket	4,000 C.Y.	$ 10.00	40,000
3' thick clay cut-off walls	2,625 C.Y.	10.00	26,250
1' gravel blanket	4,000 C.Y.	10.00	40,000
3' clay liner	12,500 C.Y.	10.00	125,000
6" dia. PVC leachate collector	1,200 L.F.	10.00	12,000
6" dia. PVC dewatering pipe	1,250 L.F.	10.00	12,500
Manholes - 48" dia. precast	2 EACH	1,600.00	3,200
Overflow weir & piping	L.S.	L.S.	25,000
Sand berms	60,400 C.Y.	6.00	362,400
Rip rap slope protection	110 C.Y.	40.00	4,400
Final Cover Over Site			
2' clay cover	8,000 C.Y.	10.00	80,000
1' topsoil and cover	5,925 C.Y.	10.00	59,250
Seeding	4.5 AC.	750.00	3,375
Monitoring Wells	4 NESTS	8,000.00	32,000
Air Sampling Unit	L.S.	L.S.	20,000
Permanent Fence	1,800 L.F.	6.00	10,800
Electric Power	L.S.	L.S.	10,000
SUBTOTAL CONSTRUCTION COST:			$ 901,175

Ditch and Parking Lot share of Cost for Constructing Containment Site

$\frac{12,100 \text{ C.Y.}}{29,475 \text{ C.Y. total}} = 0.41 \times \$901.175 =$ $ 369,482

Dredging Share of Cost of Constructing Containment Site

$\frac{17,375 \text{ C.Y.}}{29,475 \text{ C.Y. total}} = 0.59 \times \$901,175 =$ $ 531,693

ALTERNATIVE A-3a-1 COMBINED WITH B-3a

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment Maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air sampling and analysis	1 Sample/yr.	400.00	400
Inspection and Annual Report	40 Hours	60.00	2,400
Mow Grass	5 Ac.	180.00	900
Annual maintenance and repair to cover	L.S.	L.S.	3,000
Leachate collection & treatment	L.S.	L.S.	400
TOTAL ESTIMATED ANNUAL COST			$ 14,640

ALTERNATIVE A-3a-1 & B-3a

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2.	Construct Containment Site on GMC's Vacant Lot	125)	175
2a.	Construct New Storm Drain thru Parking Lot(Complete)	86)	
3.	Close Harbor & Reinforce Exist Sheet Pile Wall in Slip 3	20	28
4.	Dredge Slip 3 and Harbor	12	16
5.	Open Harbor	2)	42
6.	Dewater Containment Site	30)	
6a.	Sheet 1st section of Ditch	5)	
7.	Excavate & Backfill Ditch	125)	190
7a.	Cover Containment Site	20)	
8.	Seal Surface of Ditch, Topsoil & Seed	8	10
9.	Clean-up and Demobilization	5	7
	TOTAL		489

ALTERNATIVES A-3a-2 AND B-3b

These Alternatives are the same as A-3a-1 and B-3a except that the volume of material to be dredged from the harbor outside of slip 3 is 20,000 C.Y. rather than 500 C.Y. As a result, the cost of the containment site is greater and the shares of the site costs assigned to the two Alternatives are different.

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-3a-2

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Storm Drain			
New RCP storm drain	2,650 L.F.	$ 100.00	$ 265,000
Manholes - 8' dia. precast	9 EACH	5,000.00	45,000
Dewatering - well point	2,650 L.F.	20.00	53,000
Rip rap at outlet	50 C.Y.	50.00	2,500
Disposal of contaminated excavation in containment site	2,000 C.Y.	5.00	10,000
Surface restoration over drain	8,000 S.Y.	9.00	72,000
Excavate Contaminated Material from Parking Lot			
Relocate utilities - sewers, etc.	L.S.	L.S.	20,000
Temporary sheeting	36,000 S.F.	8.00	288,000
Well point dewatering	L.S.	L.S.	60,000
Excavation and hauling to containment site	10,100 C.Y.	10.00	101,000
Backfill excavated areas	10,100 C.Y.	10.00	101,000
Backfill original ditch (see Alternative A-2)	7,190 C.Y.	10.00	71,900
1' clay seal, topsoil and seed ditch	6,000 S.Y.	6.00	36,000
Restore parking lot excavations	700 S.Y.	7.00	4,900
Decontaminate equipment	L.S.	L.S.	20,000
Air monitoring during excavation	L.S.	L.S.	5,000
SUBTOTAL CONSTRUCTION COST:			$1,155,300
Ditch and Parking Lot Share of Containment Site Cost on OMC's Vacant Lot (see estimate attached)			283,088
TOTAL CONSTRUCTION COST:			$1,438,388
Contingencies @ 20%			287,678
Engineering @ 25%			359,597
Legal and Administrative @ 3%			43,152
TOTAL PROJECT COST:			$2,128,815

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-3b

DREDGE SLIP 3 AND UPPER HARBOR AND DISPOSE OF IN CONTAINMENT SITE ON OMC'S VACANT LOT

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Upper Harbor & Slip 3			
Dredging	30,875 C.Y.	$ 10.00	$ 308,750
Temporary sheet pile wall for closing harbor	9,000 S.F.	8.10	72,900
Reinforce existing sheet pile wall	3,900 S.F.	16.55	64,545
Chemicals & labor for water treatment	L.S.	L.S.	15,000
Miscellaneous water treatment equipment	L.S.	L.S.	30,000
Air & Water Monitoring During Dredging	L.S.	L.S.	25,000
Decontamination of Equipment	L.S.	L.S.	25,000
Construct Water Treatment Plant			
Sand Berms	13,900 C.Y.	6.00	83,400
Synthetic liner	64,000 S.F.	0.85	54,400
Gravel blanket	2,400 C.Y.	10.00	24,000
Overflow weir & piping	L.S.	L.S.	25,000
Static mixer, chemical feed pumps, etc.	L.S.	L.S.	30,000
Dismantle & place in containment cell @ closure	L.S.	L.S.	50,000
Dewatering Containment Cell Prior to Placing Final Cover	L.S.	L.S.	50,000
SUBTOTAL CONSTRUCTION COST			$ 857,995
Share of Containment Site Cost for Dredging (See Attached Estimate)	L.S.	L.S.	805,712
TOTAL CONSTRUCTION COST			$1,663,707
Contingencies @ 20%			332,741
Engineering @ 25%			415,927
Legal & Administrative @ 3%			49,911
TOTAL CONSTRUCTION COST			$2,462,286

PRELIMINARY COST ESTIMATE

CONTAINMENT SITE ON OMC'S VACANT LOT
USE WITH ALTERNATIVES B-3b AND A-3a-2
(Construct Containment Site for 54,000 c.y.)

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Level and compact site	L.S.	L.S.	$ 40,000
1' clay blanket	5,520 C.Y.	$ 10.00	55,200
3' thick clay cut-off walls	3,260 C.Y.	10.00	32,600
1' gravel blanket	5,520 C.Y.	10.00	55,200
3' clay liner	16,600 C.Y.	10.00	166,000
6" dia. PVC leachate collector	1,600 L.F.	10.00	16,000
6" dia. PVC dewatering pipe	2,000 L.F.	10.00	20,000
Manholes - 48" dia. precast	2 EACH	1,600.00	3,200
Overflow weir piping	L.S.	L.S.	25,000
Sand berms	67,400 C.Y.	6.00	404,400
Rip rap slope protection	120 C.Y.	40.00	4,800
Final Cover Over Site			
2' clay cover	11,050 C.Y.	10.00	110,500
1' topsoil and cover	7,500 C.Y.	10.00	75,000
Seeding	6 AC.	750.00	4,500
Monitoring Wells	4 NESTS	8,000.00	32,000
Air Sampling Unit	L.S.	L.S.	20,000
Permanent Fence	2,400 L.F.	6.00	14,400
Electric Power	L.S.	L.S.	10,000
SUBTOTAL CONSTRUCTION COST:			$1,088,800

Ditch and Parking Lot share of
Cost for Constructing Containment Site

$\frac{12,100 \text{ C.Y.}}{46,475 \text{ C.Y. total}} = 0.26 \times \$1,088,800 = \$ 283,088$

Dredging Share of Cost of
Constructing Containment Site

$\frac{34,375 \text{ C.Y. (includes 3,500 C.Y. for WTP)}}{46,475 \text{ of total capacity}} = 0.74 \times \$1,088,800 = \$ 805,712$

ALTERNATIVE A-3a-2 COMBINED WITH B-3b

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment Maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air sampling and analysis	1 Sample/yr.	400.00	400
Inspection and Annual Report	40 Hours	60.00	2,400
Mow Grass	5 Ac.	180.00	900
Annual maintenance and repair to cover	L.S.	L.S.	3,000
Leachate collection & treatment	L.S.	L.S.	400
TOTAL ESTIMATED ANNUAL COST			$ 14,640

ALTERNATIVE A-3a-2 & B-3b

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2.	Construct Containment Site on OMC's Vacant Lot	125)	175
2a.	Construct New Storm Drain thru Parking Lot(Complete)	86)	
3.	Close Harbor & Reinforce Exist Sheet Pile Wall in Slip 3	20	28
4.	Dredge Slip 3 and Harbor	30	42
5.	Open Harbor	2)	
6.	Dewater Containment Site	30)	42
6a.	Sheet 1st section of Ditch	5)	
7.	Excavate & Backfill Ditch	125)	190
7a.	Cover Containment Site	20)	
8.	Seal Surface of Ditch, Topsoil & Seed	8	10
9.	Clean-up and Demobilization	5	7
	TOTAL		515

ALTERNATIVES A-3a-3 AND B-3c

These Alternatives are also the same as Alternatives A-3a-1 and B-3a except that the volume of material to be removed from the harbor outside of slip 3 is 38,000 C.Y. As a result, a higher cost results for the containment site construction and the shares assigned to each Alternative are different.

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-3a-3

Remove Selected Highly Contaminated Material from the North Ditch and Parking Lot and Dispose of in Containment Site on OMC's Vacant Lot.

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Storm Drain			
New RCP storm drain	2,650 L.F.	$ 100.00	$ 265.000
Manholes 8' dia. precast	9 EACH	5,000.00	45,000
Dewatering - well point	2,650 L.F.	20.00	53,000
Rip rap at outlet	50 C.Y.	50.00	2,500
Disposal of contaminated excavation in containment site	2,000 C.Y.	5.00	10,000
Surface restoration over drain	8,000 S.Y.	9.00	72,000
Excavate Contaminated Material From Ditch and Parking Lot			
Relocate utilities - sewers, etc.	L.S.	L.S.	20,000
Temporary sheeting	36,000 S.F.	8.00	288,000
Well point dewatering	L.S.	L.S.	60,000
Excavation and hauling to containment site	10,100 C.Y.	10.00	101,000
Backfill excavated areas	10,100 C.Y.	10.00	101,000
Backfill original ditch (see Alternative A-2)	7,190 C.Y.	10.00	71,900
1' clay seal, topsoil and seed ditch	6,000 S.Y.	6.00	36,000
Restore parking lot excavations	700 S.Y.	7.00	4,900
Decontaminate equipment	L.S.	L.S.	20,000
Air monitoring during excavation	L.S.	L.S.	5,000
SUBTOTAL CONSTRUCTION COST:			$1,155,300
Ditch and Parking Lot Share of Cost of Containment Site on OMC's Vacant Lot (see estimate attached)			262,404
TOTAL CONSTRUCTION COST:			$1,417,404
Contingencies @ 20%			283,541
Engineering @ 25%			354,426
Legal and Administrative @ 3%			42,531
TOTAL PROJECT COST:			$2,098,202

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-3c

DREDGE SLIP 3 AND UPPER HARBOR & DISPOSE OF IN CONTAINMENT SITE ON OMC'S VACANT LOT

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Upper Harbor & Slip 3			
Dredging	48,900 C.Y.	$ 10.00	$ 489,000
Temporary Sleet Pile wall for Closing Harbor	9,000 S.F.	8.10	72,900
Reinforce boisting sheet pile wall	3,900 S.F.	16.55	64,545
Chemicals & Labor for Water Treatment	L.S.	L.S.	20,000
Miscellaneous Water Treatment Equipment	L.S.	L.S.	30,000
Air & Water Monitoring During Dredging	L.S.	L.S.	30,000
Decontamination of Equipment	L.S.	L.S.	25,000
Construct Water Treatment Plant			
Sand Berms	13,900 C.Y.	6.00	83,400
Synthetic liner	64,000 S.F.	0.85	54,400
Gravel blanket	2,400 C.Y.	10.00	24,000
Overflow weir & piping	L.S.	L.S.	25,000
Static mixer, chemical feed, pump, etc.	L.S.	L.S.	30,000
Dismantle & place in containment cell @ closure	L.S.	L.S.	50,000
Dewatering Containment Cell Prior to Placing Final Cover	L.S.	L.S.	50,000
SUBTOTAL CONSTRUCTION COST			$1,048,245
Share of Containment Site Cost for Dredging (See Attached Estimate)			1,049,616
TOTAL CONSTRUCTION COST			$2,097,861
Contingencies @ 20%			419,572
Engineering @ 25%			524,465
Legal & Administrative @ 3%			62,936
TOTAL PROJECT COST			$3,104,834

PRELIMINARY COST ESTIMATE

CONTAINMENT SITE ON OMC'S VACANT LOT
USE WITH ALTERNATIVES B-3c AND A-3a-3
(Construct Containment Site for 73,200 c.y.)

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Level and compact site	L.S.	L.S.	$ 45,000
1' clay blanket	6,850 C.Y.	$ 10.00	68,500
3' thick clay cut-off walls	3,822 C.Y.	10.00	38,220
1' gravel blanket	6,850 C.Y.	10.00	68,500
3' clay liner	21,510 C.Y.	10.00	215,100
6" dia. PVC leachate collector	2,000 L.F.	10.00	20,000
6" dia. PVC dewatering pipe	2,640 L.F.	10.00	26,400
Manholes - 48" dia. precast	2 EACH	1,600.00	3,200
Overflow weir piping	L.S.	L.S.	25,000
Sand berms	81,000 C.Y.	6.00	486,000
Rip rap slope protection	140 C.Y.	40.00	5,600
Final Cover Over Site			
2' clay cover	13,700 C.Y.	10.00	137,000
1' topsoil cover	9,260 C.Y.	10.00	92,600
Seeding	6 AC.	750.00	4,500
Monitoring Wells	4 NESTS	8,000.00	32,000
Air Sampling Unit	L.S.	L.S.	20,000
Permanent Fence	2,400 L.F.	6.00	14,400
Electric Power	L.S.	L.S.	10,000
TOTAL CONSTRUCTION COST:			$1,312,020

Share of Containment Site Cost for Ditch and Parking Lot Work

$\frac{12,100 \text{ C.Y.}}{61,000 \text{ C.Y. total}} = 0.20 \times \$1,312,020 =$ $ 262,404

Share of Containment Site Cost for Dredging

$\frac{48,900 \text{ C.Y.}}{61,000 \text{ C.Y. total}} = 0.80 \times \$1,312,020 =$ $1,049,616

ALTERNATIVE A-3a-3 COMBINED WITH B-3b

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment Maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air sampling and analysis	1 Sample/yr.	400.00	400
Inspection and Annual Report	40 Hours	60.00	2,400
Mow Grass	5 Ac.	180.00	900
Annual maintenance and repair to cover	L.S.	L.S.	3,000
Leachate collection & treatment	L.S.	L.S.	400
TOTAL ESTIMATED ANNUAL COST			$ 14,640

ALTERNATIVE A-3a-3 & B3c

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2.	Construct Containment Site on OMC's Vacant Lot	125)	175
2a.	Construct New Storm Drain thru Parking Lot(Complete)	86)	
3.	Close Harbor & Reinforce Exist Sheet Pile Wall in Slip 3	20	28
4.	Dredge Slip 3 and Harbor	50	70
5.	Open Harbor	2)	
6.	Dewater Containment Site	30)	42
6a.	Sheet 1st section of Ditch	5)	
7.	Excavate & Backfill Ditch	125)	190
7a.	Cover Containment Site	20)	
8.	Seal Surface of Ditch, Topsoil & Seed	8	10
9.	Clean-up and Demobilization	5	7
	TOTAL		543

ALTERNATIVES A-3b AND B-2a

Alternative A-3b is similar to Alternative A-3a except that material excavated from the north ditch and parking lot would be placed in a containment site constructed by sealing off slip 3 from the rest of the harbor rather than building a site on OMC's vacant lot.

Under Alternative B-2a, the contaminated material within slip 3 would be sealed off from the upper harbor by the construction of a sheet pile wall and slurry wall across the mouth of the slip. Approximately 21,000 C.Y. of material from the upper harbor would be dredged and pumped into the slip. Additional material would be trucked to the slip from the north ditch and parking lot under Alternative A-3b.

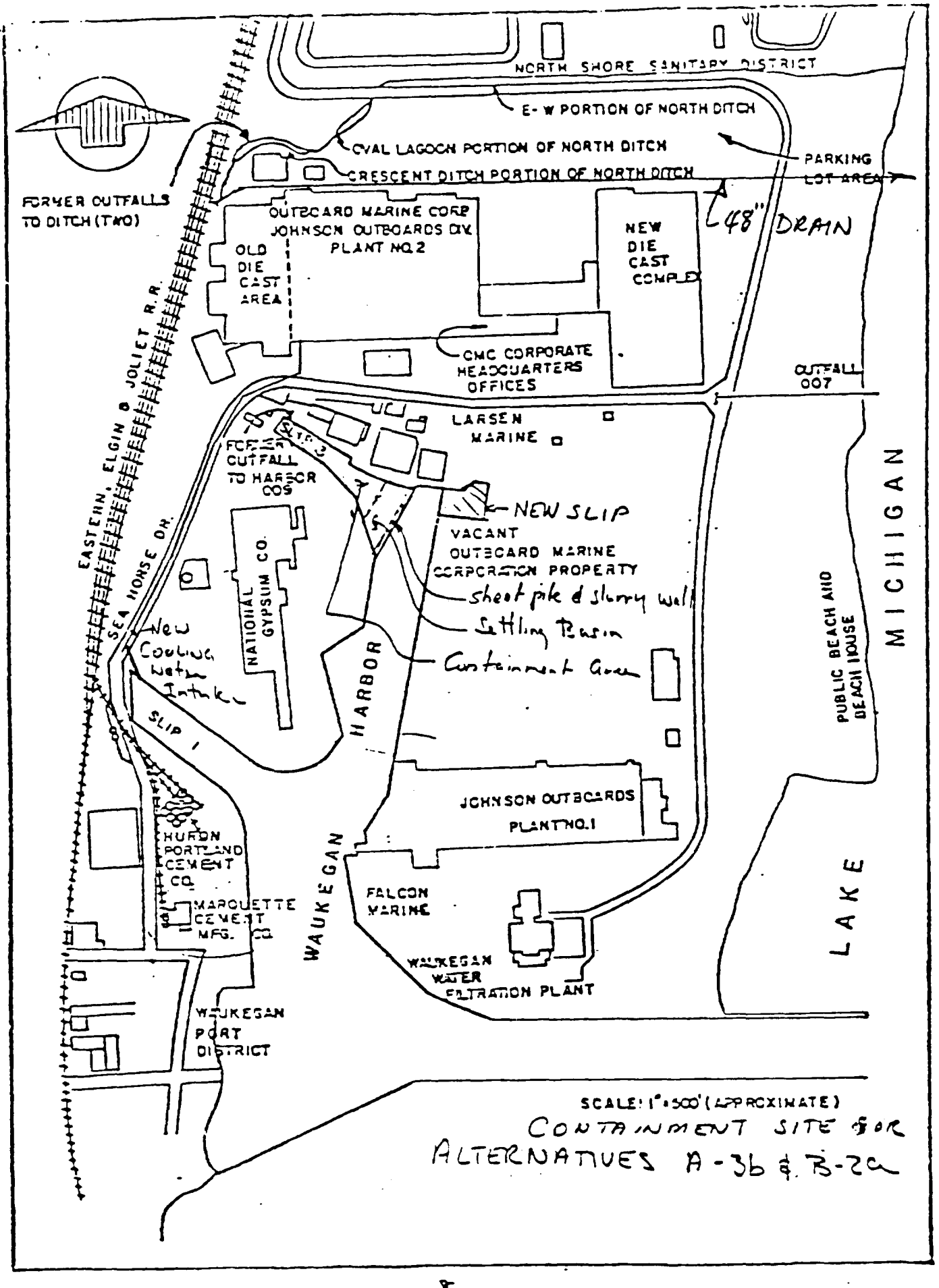
The sheet pile wall and slurry wall across the harbor would be constructed as follows:

- Drive permanent sheet piling at least 10-feet into clay; construct concrete or steel cap.
- Drive a temporary sheet piling wall about 15-feet north of the permanent wall. Backfill the space between the two walls with compacted sand from the dredge spoils piled on OMC's vacant lot.
- Construct a 3-foot thick slurry wall extending at least 5-feet into clay in the center of the compacted sand causeway between the two sheet pile walls.
- After filling the containment site, remove the temporary sheet piling wall.

A crude, water treatment facility would be constructed by installing a temporary sheet pile wall within the slip to the west of the permanent wall. Equipment for the additions of polymers would be installed to provide a reasonable degree of settling of the return dredge water, as it passed through this area into the upper harbor. The upper harbor would also be temporarily sealed off during dredging to prevent the loss of PCB's to the lake.

The conversion of slip 3 into a containment site would require the construction of a new slip for Larsen Marine. It is proposed that this slip be constructed at the northeast corner of the upper harbor as shown in the attached sketch. A new cooling water intake for OMC would also be required.

Upon completion of dredging and filling with material from the north ditch and parking lot, the surface of the slip would be sealed with clay, topsoiled and seeded. Because it will not be possible to dewater the slip to any great degree after filling, it should be anticipated that some time will be required for consolidation of the dredged material prior to placing the final cover.


NORTH SHORE SANITARY DISTRICT
E-W PORTION OF NORTH DITCH
OVAL LAGOON PORTION OF NORTH DITCH
CRESCENT DITCH PORTION OF NORTH DITCH
PARKING LOT AREA
FORMER OUTFALLS TO DITCH (TWO)
OUTBOARD MARINE CORP JOHNSON OUTBOARDS DIV PLANT NO 2
OLD DIE CAST AREA
NEW DIE CAST COMPLEX
48" DRAIN
CMC CORPORATE HEADQUARTERS OFFICES
OUTFALL 007
LARSEN MARINE
FORMER OUTFALL TO HARBOR
EASTERN, ELGIN & JOLIET R.R.
SEA HORSE DR.
NEW SLIP
VACANT OUTBOARD MARINE CORPORATION PROPERTY
sheet pile & slurry wall
Settling Basin
Containment Area
NATIONAL GYPSUM CO.
New Cooling Water Intake
SLIP 1
HARBOR
WAUKEGAN
PUBLIC BEACH AND BEACH HOUSE
MICHIGAN
LAKE
JOHNSON OUTBOARDS PLANT NO. 1
HURON PORTLAND CEMENT CO.
MARQUETTE CEMENT MFG. CO.
FALCON MARINE
WAUKEGAN WATER FILTRATION PLANT
WAUKEGAN PORT DISTRICT
SCALE: 1" = 500' (APPROXIMATE)
CONTAINMENT SITE FOR ALTERNATIVES A-3b & B-2a

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-3b

REMOVE CONTAMINATED MATERIAL FROM NORTH DITCH AND PARKING LOT AND DISPOSE OF IN SLIP 3

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Storm Drain			
New RCP Storm Drain	2,650 L.F.	$ 100.00	$ 265,000
Manholes - 8 Ft. Dia. Precast	9 EA.	5,000.00	45,000
Dewatering - Well Point	2,650 L.F.	20.00	53,000
Rip Rap at Outlet	50 C.Y.	50.00	2,500
Disposal of Contaminated Excavation in Slip 3	2,000 C.Y.	5.00	10,000
Surface Restoration over drain	8,000 S.Y.	9.00	72,000
Excavate Contaminated Material From Ditch and Parking Lot			
Relocate Utilities - sewers, etc.	L.S.	L.S.	20,000
Temporary Sheeting	36,000 S.F.	8.00	288,000
Well Point Dewatering	L.S.	L.S.	60,000
Excavation & Hauling to disposal site (slip 3)	10,100 C.Y.	10.00	101,000
Backfill excavated areas	10,100 C.Y.	10.00	101,000
Backfill original ditch (see Alt. A-2)	7,190 C.Y.	10.00	71,900
1' Clay seal, topsoil & seed ditch	6,000 S.Y.	6.00	36,000
Restore parking lot excavations	700 S.Y.	7.00	4,900
Decontaminate equipment	L.S.	L.S.	20,000
Air Monitoring during Excavation	L.S.	L.S.	5,000
SUBTOTAL CONSTRUCTION COST			$1,155,300
Ditch and Parking Lot Share of Cost of Converting Slip 3 to Containment Site			
12,100 C.Y. / 38,000 C.Y. Total = 0.32	X $1,534,722	=	$ 491,111
TOTAL CONSTRUCTION COST			$ 1,646,411
Contingencies @ 20%			329,282
Engineering @ 25%			411,603
Legal & Administrative @ 3%			49,392
TOTAL PROJECT COST			$ 2,436,688

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-2a

DREDGE UPPER HARBOR - DISPOSE OF
CONTAMINATED MATERIAL IN SLIP 3

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Upper Harbor Dredging	21,000 C.Y.	$ 10.00	$ 210,000
Temporary sheet pile wall for closing harbor	9,000 S.F.	8.10	72,900
Pumping treated return water	L.S.	L.S.	10,000
Chemicals & labor for water treatment	L.S.	L.S.	15,000
Miscellaneous water treatment equipment	L.S.	L.S.	30,000
Air & Water Monitoring During Dredging	L.S.	L.S.	30,000
Decontamination of Equipment	L.S.	L.S.	25,000
SUBTOTAL CONSTRUCTION COST			$ 392,900
Dredging Share of Cost for Converting Slip 3 to Containment Site			
$\frac{25,900}{38,000}$ = 0.68 X $1,534,722 =			$ 1,043,611
Temporary Sheet Pile Wall for Water Treatment area	6,000 S.F.	8.10	48,600
TOTAL CONSTRUCTION COST			$ 1,485,111
Contingencies @ 20%			297,022
Engineering @ 25%			371,278
Legal & Administrative @ 3%			44,553
TOTAL PROJECT COST			$ 2,197,964

PRELIMINARY COST ESTIMATE

CONVERT SLIP 3 INTO CONTAINMENT SITE
USE WITH ALTERNATIVES B-2a AND A-3b

WITHOUT WATER TREATMENT FACILITIES

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Slip for Larsen Marine			
Steel sheet pile left in place	16,000 S.F.	$ 16.55	$ 264,800
Excavation & disposal	14,000 C.Y.	10.00	140,000
New Docks, Utilities, etc.	L.S.	L.S.	350,000
Close Slip 3			
Steel sheet piling left in place	12,000 S.F.	16.55	198,600
Temporary steel sheet piling	12,000 S.F.	8.10	97,200
Sand Fill	3,000 C.Y.	2.50	7,500
Slurry Wall	32,000 C.F.	8.00	256,000
Reroute OMC Cooling Water In-Take			
10" dia. D.I.P.	1,500 L.F.	45.00	67,500
Modify in-take pumps	L.S.	L.S.	10,000
Utility Relocation at Slip 3			
Construct new drains, etc.	L.S.	L.S.	50,000
Restoration Work			
1' of sand cover from new slip	3,157 C.Y.	2.50	7,892
1' Clay seal, 1' topsoil & seed	9,470 S.Y.	9.00	85,230
TOTAL CONSTRUCTION COST			$1,534,722
WITH WATER TREATMENT FACILITIES			
Add temporary sheet pile wall for water treatment area	6,000 S.F.	8.10	48,600
TOTAL CONSTRUCTION COST			$1,583,322

ALTERNATIVE A-3b & B-2a

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	12 Samples/yr.	$ 210.00	2,520
Water samples & analysis	2 Samples/yr.	210.00	420
Inspection and annual report	40 Hours	60.00	2,400
Mow Grass	2 Ac.	180.00	360
Annual maintenance and repair to cover	L.S.	L.S.	2,800
TOTAL ESTIMATED ANNUAL COST			$ 11,000

MALCOLM PIRNIE

INTER-OFFICE CORRESPONDENCE

To: J.C. Henningson

Date: 8/5/82

From: R. P. Brownell

Subject: Waukegan Harbor

1. The following alternatives have been evaluated:

   a. North Ditch/Upland
      1. No action
      2. Stabilization
      3A. Stabilize + Limited removal of hot material (say 13,500 cy); dispose in b.2a. or b.6 below.
      3B. Stabilize + Limited removal to b3 below.
      4. On site encapsulation to 50 ppm. (See B4)
      5. Off site encapsulation to 50 ppm.(See B5)

   b. Harbor

      1. No action
      2A. Fill slip 3 with hot sand from a 3 above + dredge silted area from upper B-1 + dredge about 20,000 cy from Upper Harbor
      2B. Fill slip 3 with upper B-1 + rest of Upper Harbor
      3A. Dredge slip 3 + Upper B-1 and place hot sand (See a3 above) from No. ditch and encapsulate in vacant lot.
      3B. 3A + 20,000 cy more from Upper Harbor
      3C. Dredge slip 3 + Upper Harbor + hot sand
      3D. Dredge slip 3 + upper B-1 and encapsulate in vacant lot.
      4. Dredge slip 3 and Upper Harbor and encapsulate in parking lot (See A4)
      5. Off site encapsulation to 50 ppm (See A5)
      6. Remove any dewatered material from a.3A and 3D and incinerate. Dispose of ash offsite.

2. Considering the economic impacts which lack of dredging in the slip 3 and Upper Harbor area could have on Larsen Marine, the costly requirements associated with the disposal of material containing PCB's, the possibility of hydraulic or other natural events moving PCB laden materials in an unsecured fashion into the environment, the possibility of man made events moving PCB laden materials in an unsecured fashion into the environment, I feel that the no action options have virtually no merit and will be considered no further.

Also removing highly contaminated material from slip 3 and the North Ditch/Upland area and incinerating the material has serious problems (e.g., double and tripple handling, lengthy operation period, potential loss of PCB during extensive handling, storage and burning, use of 50 to 60 gallons of fuel oil per cubic yard of material burned) which limits its feasibility. Hence it too will be considered no further.

RPB:vm

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
BY RPB DATE SHEET NO 3 OF 3
CHKD BY DATE JOB NO
SUBJECT Volatilization

3. PCB losses:

a. Convert J to J* lb/yr by

$$J\ (ug/m^2\text{-day}) \times \text{acre} \times 0.0089 \times 365 = J^*$$

b. At 60°F (not really a direct factor in the eqn – use K_L of 0.44) and

1). 37 acres of harbor and values in 1b above

Roughly 14 lb/yr of PCB could be volatilized. Correcting for ice cover indicates about 12 lb/yr of loss.

2). 90 sq mi of near shore waters and 0.005 ug/L.

Roughly 400 lb/yr of PCB might be volatilized.

3). Losses during construction could be calculated similarly. Use 70 ug/L as water column value.

Roughly 63±0.4 lb/day/acre of exposed, agitated, contaminated water area.

5/31/82 SHEET NO. 1 OF 3

DATE JOB NO 607-01-9100

Volatilization

1. Volatilization of PCB's

a Solubility in Water Column (ug/L) based on literature

Aroclor	Hutzinger, 1974	Verschueren	Summary of Mason & Hangei
1242	—	—	200 to 340, 703
1248	100	54	—
1254	40	12	12
1260	25	—	—

b. Reported water column data in Waukegan area; based on Kontaxis 10/21/81

Location	Total PCB (ug/L)	Dissolved PCB
Slip #3	Say 0.8 to 1.0	~0.5
Rest of Harbor	0.1 to 1.0 Say 0.5	~0.05 to 0.5 Say 0.25
Outside of Harbor (within 10 km radius)	0.01 to 0.05 at 1 mile 0.005 to 0.1 in open Lake Say 0.005	? but probably most of tota

2. Methods of estimating PCB loss

a) $J = K_L C_d$

J = mass flux, $ug/m^2 day$

K_L = mass transfer coefficient, m/day
0.28 to 0.44

C_d = Dissolved PCB conc. ug/L

Source: PCB Volatilization from Hudson River
D. Toro and O'Connor

b). $Q = (MW)(K_L)(A)(X_i)$

Q = mass flux, lb/hr

MW = molecular wt of PCB

K_L = mass transfer coefficient, $\frac{lb\text{-}mole}{ft^2\text{-}hr}$

A = surface area (ft^2)

X_i = mole fraction of PCB in water

Source: Hwang -
USEPA Office of Solid Waste
Only has K_L on Aroclor 1254

Use D. Toro and O'Connor

ALTERNATIVE B-2a

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilize	15	21
2.	Construct New slip for Larson	64	
2a.	Reroute Cooling Water Intake & Utility reloc.	15	120
2b.	Construct storm drain in parking lot - complete	86	
3.	Close slip 3 & construct WTP area	75	105
4.	Dredge Harbor	21	
4a.	Sheet first section of ditch	5	29
5a.	Open Harbor	2	
5b.	Excavate & backfill ditch	125	190
5c.	Remove temporary sheeting for WTP area	2	
5d.	Close cover	20	
6.	Seal surface of Ditch topsoil & seed	8	10
7.	Clean-up & Demobilization	5	7
	TOTAL		482

ALTERNATIVE B-2b

Alternative B-2b is similar to Alternative B-2a except that approximately 38,000 C.Y. of material would be dredged from the upper harbor and placed in a sealed-off slip 3 rather than 21,000 C.Y. It is estimated that this would fill the sealed-off slip to capacity and therefore, no additional material from the north ditch or parking lot could be placed in the slip.

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-2b

Convert Slip 3 into Containment Site, Dredge 50 ppm Contaminated Material from Upper Harbor and Dispose of in Slip 3. Construct new Slip.

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Construct New Slip for Larsen Marine			
Steel sheet pile left in place	16,000 S.F.	$ 16.55	$ 264,800
Excavation and disposal	14,000 C.Y.	10.00	140,000
New docks, utilities, etc.	L.S.	L.S.	350,000
Close Slip 3			
Steel sheet piling left in place	12,000 S.F.	16.55	198,600
Temporary steel sheet pile	12,000 S.F.	8.10	97,200
Sand fill	3,000 C.Y.	2.50	7,500
Slurry wall	32,000 C.F.	8.00	256,000
Temporary sheet pile wall for water treatment area	6,000 S.F.	8.10	48,600
Reroute OMC Cooling Water In-Take			
10" dia. D.I.P.	1,500 L.F.	45.00	67,500
Modify in-take pumps	L.S.	L.S.	10,000
Utility Relocation Work At Slip 3			
Construct new drains, etc.	L.S.	L.S.	50,000
Dredge Harbor from Mouth of Slip 3 to Slip 1			
Dredging	38,000 C.Y.	10.00	380,000
Temporary sheet pile wall for closing harbor	9,000 S.F.	8.10	72,900
Pumping treated return water	L.S.	L.S.	15,000
Chemicals and labor for water treatment	L.S.	L.S.	20,000
Miscellaneous water treatment equipment	L.S.	L.S.	30,000
Air and Water Monitoring During Dredging	L.S.	L.S.	40,000
Decontamination of Equipment	L.S.	L.S.	25,000

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-2b
(Continued)

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Restoration Work			
1' of sand cover from new slip	3,157 C.Y.	$ 2.50	$ 7,892
1' clay seal, topsoil and seed	9,470 S.Y.	9.00	85,230
TOTAL CONSTRUCTION COST:			$2,166,222
Contingencies @ 20%			433,244
Engineering @ 25%			541,556
Legal & Administrative @ 3%			64,987
TOTAL PROJECT COST:			$3,206,009

ALTERNATIVE B-2b

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	12 Samples/yr.	$ 210.00	2,520
Water samples & analysis	2 Samples/yr.	210.00	420
Inspection and annual report	40 Hours	60.00	2,400
Mow Grass	2 Ac.	180.00	360
Annual maintenance and repair to cover	L.S.	L.S.	2,800
TOTAL ESTIMATED ANNUAL COST			$ 11,000

ALTERNATIVE B-2b

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2.	Construct New Slip for Larsen	64)	90
2a.	Reroute 10" Dia. cooling water intake, utility relocation	15)	
3.	Close Harbor & Construct WTP area	75	105
4.	Dredge Harbor	38	54
5.	Open Harbor	2)	84
6.	Cover Containment Site	60)	
7.	Clean-up & Demobilize	5	7
	TOTAL		361

ALTERNATIVES A-4 AND B-4

Under Alternative A-4, north ditch and parking lot material contaminated to a level of 50 ppm or greater would be removed and disposed of in a secure containment site constructed in OMC's parking lot.

Under Alternative B-4, contaminated material in slip 3 and the upper harbor would be dredged and placed in the containment site on OMC's parking lot.

The quantities to be disposed of are estimated to be as follows:

from harbor and slip 3	48,000 C.Y.
from crescent ditch and lagoon	16,800 C.Y.
from E-W portion of ditch	9,000 C.Y.
from parking lot	50,000 C.Y.
Total	123,800 C.Y.

Three secure containment cells, each with a volume of approximately 50,000 cubic yards, will be constructed on 10 acres in the area currently used as a parking lot north of OMC. A temporary water treatment lagoon, occupying an area of 1.5 acres, with a volume of 3 million gallons, will be constructed in the same area adjacent to the cells for the purpose of treating contaminated water pumped during dewatering operations and during dredging.

Most of the volume of the proposed containment cells will be below the level of the existing parking area. The finished cells will result in raising the parking lot about 7-feet above existing grade.

In order to control ground water during construction, a slurry wall will be installed around the 4,000-foot perimeter of the treatment lagoon and cell areas. Deep wells will be driven within the slurry wall area to pump ground water to levels below the bottom elevation of the containment cells. Ground water will be treated in the lagoon and discharged to a 48-inch storm sewer that will be constructed in a east-west direction, adjacent to the existing railroad siding, from an existing 36-inch culvert, to the lake.

The permanent containment cells will be lined with 5-foot of clay and fitted with an underdrain system for final dewatering purposes.

The sequence of construction is very important. First, all utilities within the proposed cell area will be relocated and a new storm drain constructed to divert water from the north ditch. Contaminated materials excavated during utility work will be stockpiled and covered to prevent volatilization of PCBs. Next, the slurry wall will be built and a water treatment system, consisting of a flocculation basin and settling pond, will be constructed at the east end of the site on top of the parking lot.

When the water treatment plant is ready for use, deep wells or a well point system will be installed inside the slurry wall. Water from the deep wells will be pumped to the treatment system and discharged via the new storm drain.

PRELIMINARY COST ESTIMATE

CONTAINMENT SITE ON OMC'S PARKING LOT

ALTERNATIVES A-4 AND B-4

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
12" H.P. gas relocation	2,000 L.F.	$ 50.00	$ 100,000
Slurry wall 2' wide X 40' deep	320,000 C.F.	7.00	2,240,000
Water Treatment Plant			
Earthwork	12,150 C.Y.	3.00	36,450
Bentonite seal on bottom & side	60,000 S.F.	1.00	60,000
Outlet weir & piping	L.S.	L.S.	25,000
Under drainage system	800 L.F.	10.00	8,000
Timber baffle wall	1,200 S.F.	1.25	1,500
Floating Flocculator	2 EA.	35,000.00	70,000
Chemical feed pumps, etc.	L.S.	L.S.	20,000
Containment Cells			
Excavation	180,000 C.Y.	2.50	450,000
Compacted Sand Berms	24,240 C.Y.	2.50	60,600
Clay liner (5' thick)	63,900 C.Y.	10.00	639,000
Underdrain & leachate collection			
6" - Perf. pipe	5,000 L.F.	15.00	75,000
48" dia. collector MH's	3 EA.	1,500.00	4,500
Dewatering during excavation	L.S.	L.S.	400,000
Outlet structures w/pumps	3 EA.	25,000.00	75,000
Dewater All Cells			
Temporary pumping	L.S.	L.S.	20,000
Water Treatment	L.S.	L.S.	40,000
Close All Cells			
2' Clay cover	25,500 C.Y.	10.00	255,000
12" gravel layer	15,000 C.Y.	10.00	150,000
Remove WTP & Dispose in Cells			
Excavation	7,800 C.Y.	4.00	31,200
Remove Equipment	L.S.	L.S.	5,000
Backfill Area	8,500 C.Y.	4.00	34,000
Restore Area			
Repave Parking area	55,500 S.Y.	9.00	499,500
Misc. catch basins & other surface drainage	L.S.	L.S.	75,000

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-4

DREDGE HARBOR - DISPOSE OF CONTAMINATED MATERIAL IN CONTAINMENT CELL IN OMC'S PARKING LOT

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Harbor			
Temporary sheet pile wall across harbor	9,000 S.F.	$ 8.10	$ 72,900
Reinforce existing sheet pile wall	3,900 S.F.	16.55	64,545
Hydraulic dredging	48,000 C.Y.	10.00	480,000
Return water pumping to WTP	L.S.	L.S.	2,000
Return water treatment	L.S.	L.S.	20,000
Return water pumping to Harbor	L.S.	L.S.	10,000
SUBTOTAL:			$ 649,445
Share of cost for Construction of Water Treatment Plant, Containment Cells & Operating Costs (See Attached Estimate)			$2,308,702
TOTAL CONSTRUCTION COST:			$2,958,147
Contingencies @ 20%			591,629
Engineering @ 25%			739,537
Legal & Administrative @ 3%			88,744
TOTAL PROJECT COST:			$4,378,057

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Backfill ditch	14,000 C.Y.	$ 4.00	$ 56,000
1' clay seal, topsoil & seed ditch	6,000 S.Y.	8.00	48,000
Place material from Parking Lot in containment cell	48,000 C.Y.	2.50	120,000
SUBTOTAL:			$1,248,300
Share of cost for construction of Water Treatment Plant, Containment Cells & Operating Costs (See Attached Estimate)			•
TOTAL CONSTRUCTION COST:			$4,859,348
Contingencies @ 20%			971,870
Engineering @ 25%			1,214,837
Legal & Administrative @ 3%			145,780
TOTAL PROJECT COST:			$2,332,487

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-4

Remove 50 PPM & Greater Contaminated Material from North Ditch, Encapsulate, together with material from Harbor, in a containment site constructed in OMC's Parking Lot.

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
New RCP storm sewer	2,650 L.F.	$ 100.00	$ 265,000
8' Dia. Precast MH	9 EA.	5,000.00	45,000
Well point dewatering	2,650 L.F.	20.00	53,000
Rip Rap @ Outlet	50 C.Y.	50.00	2,500
Move & stockpile contaminated excavation	2,000 C.Y.	2.50	5,000
10" Dia. DIP sanitary sewer	1,370 L.F.	50.00	68,500
48" Dia. MH (precast)	8 EA.	1,400.00	11,200
Poured-in-place MH	1 EA.	10,000.00	10,000
Excavate Crescent Ditch & Lagoon			
Plug culvert between lagoon & ditch	L.S.	L.S.	500
Steel sheeting around building & tank	10,250 S.F.	8.40	86,100
Soil stabilization @ water tank	L.S.	L.S.	20,000
Remove & replace R.R. siding	300 L.F.	40.00	12,000
Mud cat excavation	16,800 C.Y.	10.00	168,000
Clamshell excavation	3,900 C.Y.	12.00	46,800
Return water pumping to WTP	L.S.	L.S.	1,500
Return water treatment	L.S.	L.S.	15,000
Return water pumping to lagoon	L.S.	L.S.	7,500
Backfill Crescent ditch & lagoon	19,500 C.Y.	4.00	78,000
1' clay seal, topsoil & seed	1,800 S.Y.	9.00	16,200
Excavate E-W Ditch			
Plug end of E-W ditch @ footbridge	100 C.Y.	10.00	1,000
Mud cat dredge to 5' depth	9,000 C.Y.	10.00	90,000
Return water pumping to WTP	L.S.	L.S.	1,500
Return water treatment	L.S.	L.S.	15,000
Return water pumping to ditch	L.S.	L.S.	5,000

When the ground water table has been lowered about 12-feet, two containment cells will be built adjacent to the water treatment plant. Sampling data indicates that the soils in this area are relatively free of PCBs.

Once the first two cells have been made ready, the harbor will be sealed and dredged. Dredged material will be pumped to the westerly cell and the slurry water treated in the water treatment system prior to return to the dredging area. After dredging the harbor, this first cell will be dewatered and a temporary clay cover placed over it.

The second cell will be utilized to contain material removed from the crescent ditch, oval lagoon, E-W ditch, and that portion of the parking area between the slurry wall and the ditch. As in Alternatives A-5 and B-5, a mudcat, assisted by a clam shell for deep excavation, will be employed to dredge these areas.

After the ditch is excavated, construction of the third cell will begin. Much of the existing ground in the area to be occupied by the third cell has been contaminated by PCBs. Therefore, materials removed during excavation of the third cell will be stockpiled, temporarily, in the partially filled second cell. Once the third cell is complete, this material will be transferred to it. Finally, the water treatment plant will be removed and placed in the third cell and the entire area covered and restored.

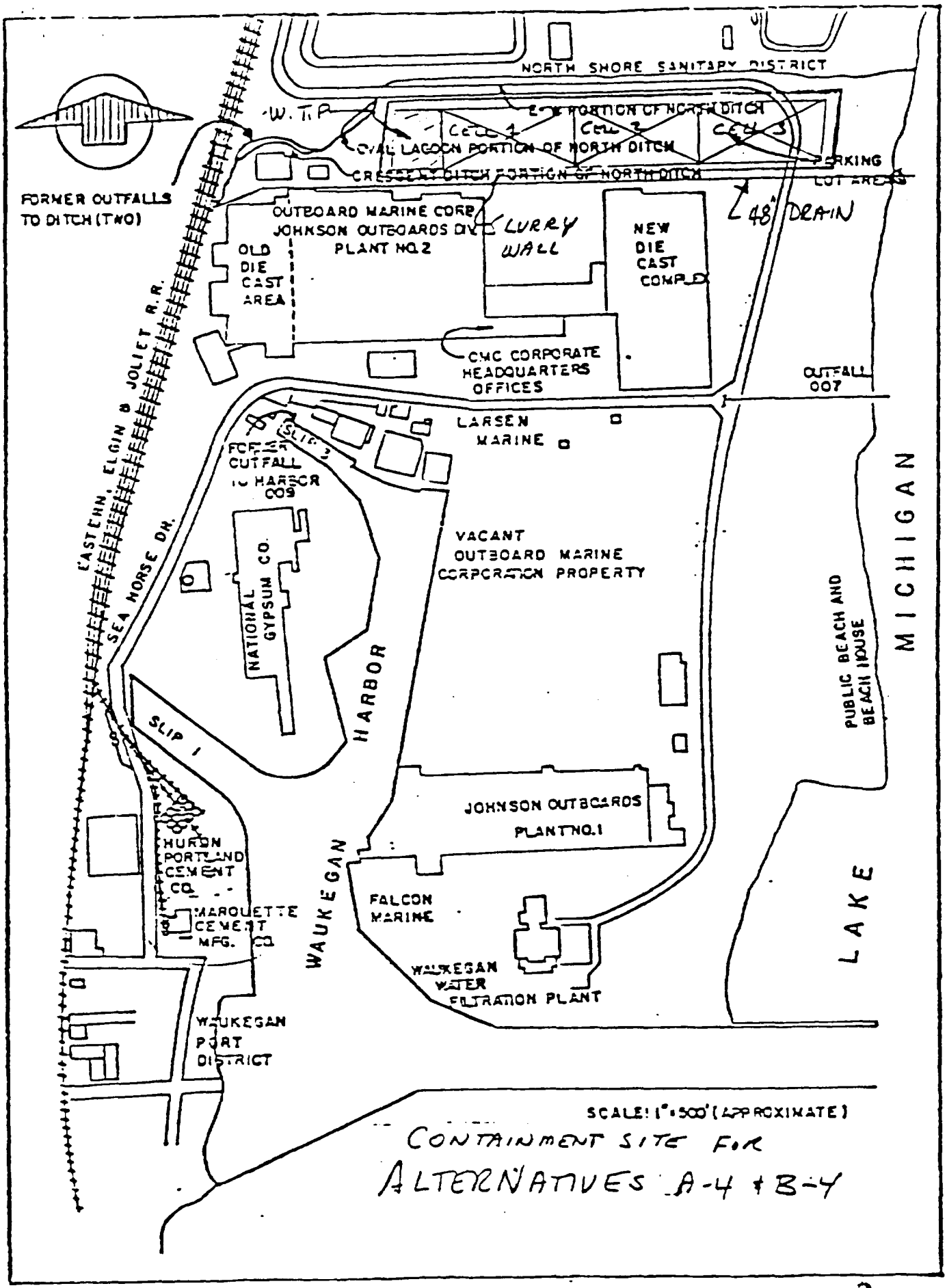
DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dispose of clean excess excavation	55,000 C.Y.	$ 7.00	$ 385,000
Other Costs During Construction			
Monitoring & Sampling air & water	L.S.	L.S.	100,000
Decontamination of Equipment	L.S.	L.S.	60,000
SUBTOTAL CONSTRUCTION COSTS			$ 5,919,750

Share assigned to North Ditch under Alternative A-4:

$\frac{75,800 \text{ C.Y.}}{123,800 \text{ C.Y. total}} = .61 \times 5,919,750 = \$3,611,048$

Share assigned to Harbor under Alternative B-4

$\frac{4,800 \text{ C.Y.}}{123,800 \text{ C.Y.}} = 0.39 \times 5,919,750 = \$2,308,702$


NORTH SHORE SANITARY DISTRICT
W.T.P.
OVAL LAGOON PORTION OF NORTH DITCH
CRESCENT DITCH PORTION OF NORTH DITCH
PARKING LOT AREA
48" DRAIN
FORMER OUTFALLS TO DITCH (TWO)
OUTBOARD MARINE CORP. JOHNSON OUTBOARDS DIV. PLANT NO. 2
SLURRY WALL
OLD DIE CAST AREA
NEW DIE CAST COMPLEX
CMC CORPORATE HEADQUARTERS OFFICES
OUTFALL 007
LARSEN MARINE
FORMER OUTFALL TO HARBOR
EASTERN, ELGIN & JOLIET R.R.
SEA HORSE DR.
NATIONAL GYPSUM CO.
VACANT OUTBOARD MARINE CORPORATION PROPERTY
HARBOR
SLIP 1
PUBLIC BEACH AND BEACH HOUSE
MICHIGAN
JOHNSON OUTBOARDS PLANT NO. 1
HURON PORTLAND CEMENT CO.
MARQUETTE CEMENT MFG. CO.
WAUKEGAN
FALCON MARINE
WAUKEGAN WATER FILTRATION PLANT
LAKE
WAUKEGAN PORT DISTRICT
SCALE: 1" = 500' (APPROXIMATE)
CONTAINMENT SITE FOR
ALTERNATIVES A-4 + B-4

ALTERNATIVES A-4 AND B-4

ESTIMATED ANNUAL O&M COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air Monitoring	1 Sample/yr.	400.00	400
Yearly site inspection and report	40 Hours	60.00	2,400
Annual maintenance and repair to cover	L.S.	L.S.	2,000
Leachate collection and treatment	L.S.	L.S.	400
TOTAL ESTIMATED ANNUAL COST			$ 12,740

ALTERNATIVES A-4 & B-4

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilization	15	21
2a.	Relocate utilities in Parking Lot	30	120
2b.	Construct new storm drain thru Parking Lot	86	
3a.	Construct slurry wall around Parking Lot	100	140
3b.	Construct water treatment	60	
4a.	Dewater and construct containment cells	140	
4b.	Reinforce existing sheet pile wall in harbor	10	196
4c.	Close harbor near slip 1	20	
5.	Dredge harbor	48	67
6.	Open harbor	3	3
7.	Dredge dtich	30	42
8a.	Remove water treatment plant & place in cells	10	
8b.	Dewater all cells	45	63
8c.	Backfill ditch, topsoil and seed	32	
9.	Place final cover over cells and repave parking lot	60	84
10.	Clean-up & Demobilize	5	7
	TOTAL		743

ALTERNATIVES A-5 AND B-5

Under Alternative A-5, a new storm drain would be constructed through OMC's parking lot and 50 ppm and greater contaminated material from the north ditch and parking lot would be removed and disposed of in a new, off-site landfill.

Under Alternative B-5, 50 ppm and greater contaminated material from slip 3 and the upper harbor would be dredged and disposed of in the off-site landfill.

An estimate of the quantities to be disposed of under these two Alternatives is as follows:

from harbor north of slip 1	48,000 C.Y.
from crescent ditch and lagoon	16,800 C.Y.
from E-W portion of ditch	9,000 C.Y.
from parking lot	50,000 C.Y.
Total	123,800 C.Y.

Under these two Alternatives, it is assumed that a 60^{+} acre site with suitable clay soils can be located and purchased within 20^{+} miles of the harbor. A 200,000 C.Y. capacity secure landfill would be built on this site. A temporary, dewatering and containment lagoon would be constructed on OMC's vacant lot. This lagoon would have a capacity of approximately 75,000 C.Y., and would be filled and emptied twice during the dredging process. A settling basin would be constructed as part of the temporary lagoon to treat dredge return water. The materials used to construct the lagoon and settling basin would be disposed in the landfill upon completion of dredging.

The upper harbor and slip 3 would be dredged prior to dredging the north ditch and parking lot. As in other harbor dredging Alternatives, the mouth of the harbor would be sealed-off with a temporary sheet pile wall to prevent loss of PCB's to the lake, and treated, slurry water would be returned to the area of the dredge.

After dredging the harbor, the temporary lagoon would be dewatered through an activated carbon pressure filter and the treated water discharged to the harbor. The material in the lagoon would then be trucked to the secure, off-site landfill.

After the harbor has been dredged, dredging would begin in the north ditch and parking lot.

In order to excavate the oval lagoon and crescent ditch, the culvert at the north (discharge) end of the lagoon would be plugged to contain sufficient water to float a mudcat dredge. This dredge would excavate the oval lagoon to a depth of 9-feet below its present bottom and the easterly end of the crescent ditch to approximately 5-feet. Contaminated material in the westerly end of the crescent ditch, at depths over 15-feet, the maximum working depth for a mudcat, would be excavated by clam shell and placed at a shallower depth for removal by the mudcat. All dredged material would be pumped directly to the temporary dewatering lagoon. Slurry water would be returned to the dredge area via a pipeline and skid mounted pump.

After dredging, the crescent ditch and oval lagoon would be backfilled, sealed, topsoiled and seeded. The temporary lagoon would be dewatered and the material trucked to the landfill; and the temporary lagoon and water treatment plant would be dismantled and hauled to the landfill. The placement of cover material at the off-site landfill would be carried out as material is placed in the site to minimize volatizations of PCBs.

PRELIMINARY COST ESTIMATE

ALTERNATIVE A-5

REMOVE CONTAMINATED MATERIAL FROM DITCH AND LAGOON, DISPOSE OF IN NEW, OFF-SITE LANDFILL

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Relocate Utilities in Parking Lot			
48" RCP drain	2,650 L.F.	$ 100.00	$ 265,000
96" Precast MHs	9 EA.	5,000.00	45,000
Well point dewatering	2,650 L.F.	20.00	53,000
Disposal of contaminated Exc.	2,000 C.Y.	15.00	30,000
12" H.P. Gas	1,850 L.F.	50.00	92,500
10" D.I.P. Sewer	660 L.F.	50.00	33,000
48" precast MHs	3 EA.	1,400.00	4,200
Poured-in-place MH	1 EA.	10,000.00	10,000
Excavate Crescent Ditch & Lagoon			
Plug culvert between lagoon & ditch	L.S.		500
Steel sheeting around bldg. & tank	10,250 S.F.	8.40	86,100
Soil stabilization @ water tank	L.S.		20,000
Remove & replace railroad siding	300 L.F.	40.00	12,000
Mud cat excavation	16,800 C.Y.	10.00	168,000
Clam shell excavation	3,900 C.Y.	12.00	46,800
Return water pumping from lagoon	L.S.		10,000
Backfill Crescent Ditch & Lagoon			
Sand backfill	19,500 C.Y.	6.00	117,000
Seal, topsoil & seed	1,800 S.Y.	9.00	16,200
Excavate E-W Ditch & Parking Lot			
Plug E-W ditch @ foot bridge	100 C.Y.	10.00	1,000
Dredge ditch (mud cat) to 5' depth	9,000 C.Y.	10.00	90,000
Strip parking lot to water table	18,000 C.Y.	4.00	72,000
Mudcat dredge parking lot	30,000 C.Y.	10.00	300,000
Return water pumping from lagoon	L.S.		70,000
Backfill Ditch & Parking Lot			
Sand backfill	48,000 C.Y.	6.00	288,000
Seal, topsoil & seed over ditch	6,000 S.Y.	6.00	36,000
Restore parking area & road	27,000 S.Y.	9.00	243,000

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dewater & Dispose Material in Containment Lagoons			
Dewater via activated carbon filters	L.S.	$	$ 50,000
Excavate material from lagoon & truck to secure disposal site	73,800 C.Y.	15.00	1,107,000
Handle at disposal site	73,800 C.Y.	2.00	147,600
CONSTRUCTION COST SUBTOTAL			$ 3,413,900
Share of Off-Site Secure Landfill			$ 1,078,022
Share of Temp. Containment Site, Dewatering lagoon & WTP			899,918
Share of Dismantling Temp. Containment & Dewatering Lagoon			786,900
TOTAL CONSTRUCTION COST			$ 6,178,740
Contingencies @ 20%			1,235,748
Engineering @ 25%			1,544,685
Legal & Administrative @ 3%			185,362
TOTAL PROJECT COST			$ 9,144,535

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-5

REMOVE CONTAMINATED MATERIAL FROM HARBOR, DISPOSE OF IN NEW, OFF-SITE LANDFILL

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Dredge Harbor			
Dredge between Slip 1 and Slip 3	39,000 C.Y.	$ 10.00	$ 390,000
Sheet pile wall across Slip 1	9,000 S.F.	8.10	72,900
Dredge Slip 3	9,000 C.Y.	10.00	90,000
Reinforce existing sheet pile wall	3,900 S.F.	16.55	64,545
Dewater containment lagoon	L.S.	L.S.	45,000
Excavate Material from Lagoon and Truck to Secure Disposal Site	48,000 C.Y.	15.00	720,000
Handle at Disposal Site	48,000 C.Y.	2.00	96,000
SUBTOTAL CONSTRUCTION COST:			$1,478,445
Share of Off-Site Secure Landfill			689,228
Share of Temporary Containment Site, Dewatering Lagoon and WTP			575,357
Share of Dismantling Temporary Containment and Dewatering Lagoon			503,100
TOTAL CONSTRUCTION COST:			$3,246,130
Contingencies @ 20%			649,225
Engineering @ 25%			811,532
Legal & Administrative @ 3%			97,384
TOTAL PROJECT COST:			$4,804,271

PRELIMINARY COST ESTIMATE

OFF-SITE SECURE LANDFILL, TEMPORARY CONTAINMENT
AND DEWATERING LAGOON AND WATER TREATMENT PLANT
USE WITH ALTERNATIVES A-5 & B-5

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Off-site Secure Landfill			
Purchase Land	60 A.C.	$ 5,000.00	$ 300,000
Excavate Clay	76,000 C.Y.	4.00	304,000
Construct Berms (Clay)	30,000 C.Y.	3.00	90,000
Construct Clay Cover	35,000 C.Y.	6.00	210,000
Construct Gravel Cover	18,200 C.Y.	8.00	145,600
Topsoil	23,700 C.Y.	10.00	237,000
Seed	15± A.C.	750.00	11,250
Leachate Collection System	3,600 L.F.	10.00	36,000
Permanent Fencing	3,500 L.F.	6.00	21,000
Monitoring Wells	6 NESTS	8,000.00	48,000
Site Drainage	L.S.	L.S.	100,000
Construct Access Road	1,000 L.F.	50.00	50,000
Decontamination Station	L.S.	L.S.	25,000
Electric Power	L.S.	L.S.	40,000
Misc. (Compaction of bottom, etc.)	L.S.	L.S.	150,000
CONSTRUCTION COST SUBTOTAL			$ 1,767,250
Temporary Containment & Dewatering Lagoon with Treatment Plant on Vacant OMC Land			
Level Existing dredge spoil piles	30,000 C.Y.	1.50	45,000
Excavate for lagoon base	28,000 C.Y.	1.50	42,000
Bentonite Seal	253,000 S.F.	1.00	253,000
Install leachate drains	3,000 L.F.	10.00	30,000
2' Gravel layer	18,500 C.Y.	10.00	185,000
Construct sand berms	2,750 C.Y.	2.50	6,875
2' Clay liners	22,700 C.Y.	10.00	227,000
Install underdrain system	L.S.	L.S.	50,000
2' Gravel layer	22,700 C.Y.	10.00	227,000
Overflow weir & piping	1 EA.	25,000.00	25,000
Monitoring wells, air sampling equip., etc.	L.S.	L.S.	60,000
Roadway & site drainage	L.S.	L.S.	60,000
Install electric service	L.S.	L.S.	10,000
Shape & compact basin in sand	L.S.	L.S.	40,000
Hypalon liner	6,400 S.F.	0.85	54,400

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Overflow weir, piping & pump	L.S.	L.S.	$ 25,000
Static mixer, chem. feed equip., etc.	L.S.	L.S.	25,000
Pumping from Cell to WTP			
O&M	L.S.	L.S.	5,000
Chemicals & staffing O&M	L.S.	L.S.	60,000
Dismantle & remove	L.S.	L.S.	45,000
CONSTRUCTION COST SUBTOTAL			$1,475,275
Dismantle Containment Lagoon - Dispose at Secure Disposal Site			
Excavate berms, gravel layer, clay liner & clay liner under-drain material - haul to disposal site.	70,000 C.Y.	15.00	1,050,000
Handle at disposal site	70,000 C.Y.	2.00	140,000
Decontamination of Equipment	L.S.	L.S.	50,000
Monitoring during dredging	L.S.	L.S.	50,000
CONSTRUCTION COST SUBTOTAL			$ 1,290,000
TOTAL CONSTRUCTION COST			$ 4,532,525

SUMMARY - Harbor Share = $\frac{48,000}{123,800} = .39$ X Cost

Ditch Share = $\frac{75,800}{123,800} = .61$ X Cost

		HARBOR SHARE (X .39)	DITCH SHARE (X .61)
Off-site Landfill	$1,767,250	$689,228	$1,078,022
Temp. cont. & WTP	$1,475,275	575,357	899,918
Dismantle	$1,290,000	503,100	786,900

ALTERNATIVES A-5 AND B-5

ESTIMATED ANNUAL O&M COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air monitoring	1 Sample/yr.	400.00	400
Yearly inspection and report	40 Hours	60.00	2,400
Annual maintenance and repairs to cover	L.S.	L.S.	3,800
Mow grass	15 Ac.	180.00	2,700
Leachate pumping and treatment	L.S.	L.S.	400
Misc. (fencing, signs and maintenance at access road)	L.S.	L.S.	600
TOTAL ESTIMATED ANNUAL COST			$ 17,840

ALTERNATIVES A-5 & B-5

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1a.	Construct off-site landfill	170	240
1b.	Construct temporary Dewatering lagoon & containment cell on OMC's vacant lot	110	
1c.	Construct new storm drain in OMC's parking lot	86	
2.	Close harbor & reinforce existing slip wall	20	28
3.	Dredge slip 3 & harbor	48	68
4.	Open harbor	2	63
4a.	Dewater containment cell & water treatment plant	45	
5.	Remove dredged material from temporary cell, truck to off-site landfill	60	84
6a.	Dredge and excavate ditch and parking lot	80	133
6b.	Dewater containment cell and water treatment plant	15	
6c.	Backfill ditch and parking lot	90	
7.	Remove dredged material from temporary cell, truck to landfill	96	134
8.	Remove temporary cell and water treatment plant, truck to landfill	87	121
9.	Complete final cover at landfill	10	14
10.	Clean-up & Demobilize	5	7
	TOTAL		892

ALTERNATIVE B-6

Under Alternative B-6, slip 3 and approximately 500 C.Y. of contaminated material in the upper harbor near the mouth of the slip which must be removed to prevent loss of use of the harbor by Larsen Marine Co. would be dredged and disposed of in a secure containment site constructed on OMC's vacant lot. This Alternative is the same as Alternative B-3a, except that the containment site would only be used for the material from the slip and upper harbor, and no capacity would be provided for material from the north ditch or parking lot.

PRELIMINARY COST ESTIMATE

ALTERNATIVE B-6

DREDGE HARBOR & SLIP 3; DISPOSE OF IN CONTAINMENT SITE ON OMC VACANT LOT

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Containment site on OMC vacant lot			
Site Work - level & compact area	L.S.	L.S.	$ 30,000
1' clay blanket (compacted)	1,720 C.Y.	$ 10.00	17,200
1' gravel drainage course	1,720 C.Y.	10.00	17,200
Compacted sand berm	24,000 C.Y.	6.00	144,000
Clay cut off wall	1,600 C.Y.	10.00	16,000
3' clay liner	4,900 C.Y.	10.00	49,000
6" leachate collector	900 L.F.	10.00	9,000
6" dewatering pipe	800 L.F.	10.00	8,000
48" dia. collector MH	1 EA.	1,600.00	1,600
Overflow weir & piping	L.S.	L.S.	25,000
Permanent fence	1,500 L.F.	6.00	9,000
Electric power	L.S.	L.S.	10,000
Final cover			
2' clay cover	3,450 C.Y.	10.00	34,500
1' topsoil cover	1,800 C.Y.	10.00	18,000
Seeding	2.4 A.C.	750.00	1,800
Construct Water Treatment Plant			
Sand Berms	11,000 C.Y.	6.00	66,000
Synthetic liner	50,000 S.F.	0.85	42,500
Gravel blanket	2,000 C.Y.	10.00	20,000
Overflow weir & piping	L.S.	L.S.	25,000
Static mixer, chemical feed pumps, etc.	L.S.	L.S.	30,000
Dismantle & place in containment cell @ closure	L.S.	L.S.	30,000
Dredge Upper Harbor & Slip 3			
Dredging	11,375 C.Y.	10.00	113,750
Temporary sheet pile wall for closing harbor	9,000 S.F.	8.10	72,900
Reinforce existing sheet pile wall	3,900 S.F.	16.55	64,545
Chemicals & labor for water treatment	L.S.	L.S.	12,000
Miscellaneous water treatment equipment	L.S.	L.S.	30,000

ALTERNATIVE B-6 (continued)

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Air & Water Monitoring During Dredging	L.S.	L.S.	$ 25,000
Decontamination of Equipment	L.S.	L.S.	25,000
Dewatering Containment Cell Prior to Placing Final Cover	L.S.	L.S.	50,000
SUBTOTAL CONSTRUCTION COST			$ 996,995
Contingencies @ 20%			199,399
Engineering @ 25%			249,249
Legal & Administrative @ 3%			29,910
TOTAL PROJECT COST			$1,475,553

ALTERNATIVE B-6

ESTIMATED ANNUAL O&M COST

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Equipment Maintenance and electric power charges	L.S.	L.S.	$ 2,500
Ground water sampling and analysis	24 Samples/yr.	$ 210.00	5,040
Air sampling and analysis	1 Sample/yr.	400.00	400
Inspection and Annual Report	40 Hours	60.00	2,400
Mow Grass	3 Ac.	180.00	540
Annual maintenance and repair to cover	L.S.	L.S.	2,000
Leachate collection & treatment	L.S.	L.S.	400
TOTAL ESTIMATED ANNUAL COST			$ 13,280

ALTERNATIVE B-6

CONSTRUCTION SCHEDULE

SEQUENCE	DESCRIPTION	DURATION (WORKING DAYS)	DURATION (CALENDER DAYS)
1.	Mobilize	15	21
2.	Construct containment site and water treatment plant on OMC's vacant lot	125	175
3.	Close harbor and reinforce existing sheet pile wall in slip 1	20	28
4.	Dredge slip 3 and harbor	12	16
5.	Open harbor	3)	
5a.	Dewater containment site and dismantle WTP	30)	45
6.	Cover containment site	20	28
7.	Clean-up and Demobilize	5	7
	TOTAL		323

MALCOLM PIRNIE

INTER-OFFICE CORRESPONDENCE

To: R.P. Brownell

Date: 8/5/82

From: H. L. Shahabian

Subject: Waukegan Harbor Siltation

The review of available reports and data related to sedimentation/siltation of Waukegan Harbor resulted in the following:

1. The main source of siltation and sedimentation of Waukegan Harbor appears to be Lake Michigan. Based on a limited sampling period performed by Argonne National Laboratory, a two-phase flow often exists at the mouth of the Harbor: Water flows out of the harbor at the surface and correspondingly into the Harbor at the bottom of the channel. The bottom current from the Lake carries with it sediments that are deposited in the channel.

2. The channel and a portion of the Harbor located near the mouth have been regularly dredged in the past. The average quantity of dredged material was 20,000 yd^3/year.

3. No dredging has taken place since 1977.

4. The upper reach of the Harbor, slip #3, is not affected by sediments originated from Lake Michigan.

5. The probable source of siltation of slip #3 (surface area 70,000 ft^2) is the overland flow and storm sewers with outlets into slip #3.

6. Overland flows and storm sewers carry the dust and dirt accumulated in street curbs and parking areas. An estimate was made of the amount of solids that could reach slip #3. The estimate was based on published values[a] for other cities in the U.S. for similar (industrial) land use, and for the City of Milwaukee, located in the same geographical area as Waukegan.

7. These estimates are:

   - Based on the Milwaukee study: 560,000 lbs/year.
   - Based on average values in U.S.: 290,000 lbs/year.

Considering a specific weight of 110 lbs/ft^3 these values would correspond to 5,100 ft^3/yr. and 2,700 ft^3/yr respectively. Moreover, if a uniform distribution of these sediments is assumed into slip #3 and with no movement of these sediments into other parts of the Harbor 0.5 to 0.9 inches of sediments might be expected to accumulate into slip #3.

Correspondingly, 13 to 24 years period would be required to accumulate one foot of sediments.

8. A similar analysis based on the Universal Soil Loss Equation[a] results in similar values 0.05 to 0.1 ft/yr. Or 12 to 24 years to accumulate one foot of sediments.

9. A draft of 6 to 8 ft is required in slip #3 for the free movements of boats. Based on the bathometric contour map in Mason & Hanger report the attached figures were developed. Figure one identifies the areas in slip #3 with draft less than 6 to 8 ft. The draft is based on the low water datum of 576.8 ft.

10. The second figure projects those conditions into the future based on the values estimated above: 12 to 24 years to accumulate one foot of sediments.

11. Lake fluctuations - The hydrograph of monthly mean levels of Lake Michigan (1960-1980) are shown on Figure 3. The lake levels have a seasonal cyclicity. The annual low levels generally occur during the winter months (Jan. to March) and the high levels in summer (June to August). In addition to the seasonal variations, the annual mean levels appear to have a very low frequency cycle not unlike other hydrologic phenomena. Thus high water level years tend to follow each other and similarly for low water level years. However, it is difficult to predict when the next low water levels will begin.

An examination of the 1960-1980 hydrograph indicate that the levels were above the Low Water Datum (576.8 feet) since 1967. Record highs (from 1900 to 1980) were registered in 1973-74. However, during the 1963-64 years lake levels were close but generally below the Low Water Datum. The minimum of record was registered in March-April 1964.

12. Since the lake level fluctuates, the historical minimum lake level (575.4) is used in Figure 4 together with the present sediment conditions.

13. The historical minimum lake level (575.4 ft) is used in Figure 5 together with projected sediment levels of 12-14/yr. Figure 3 shows that the totality of slip #3 will have a draft of less than 8 feet, with all of the mooring areas with drafts less than 6 feet.

(a) Overton, D.E., M.E. Meadows, "Stormwater Modeling" Academic Press, 1976

HLS:vm
cc: J. C. Henningson

WAUKEGAN HARBOR SLIP # 3

DEPTH OF WATER ABOVE ROCK LAYER : PRESENT CONDITIONS

WATER SURFACE ELEVATION @ LOW WATER DATUM: EL 576.8

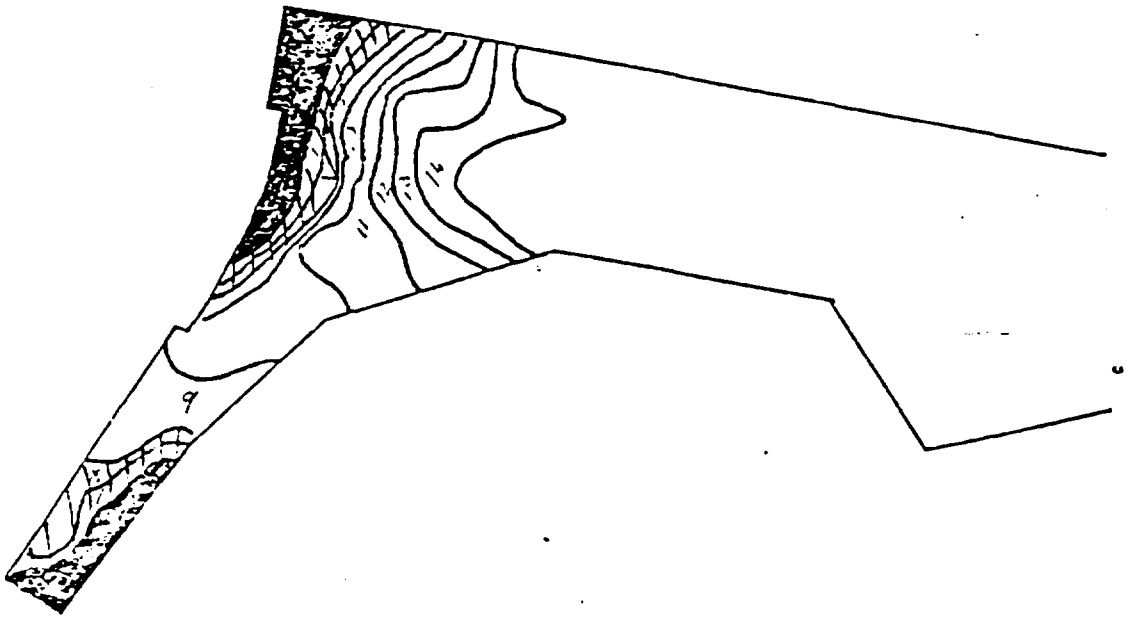


FIG. 1

WAUKEGAN HARBOR SLIP # 3

FUTURE CONDITION

DEPTH OF WATER ABOVE MUCK LAYER : 12.26 FT W/ 4 INCH

WATER SURFACE ELEVATION @ LOW WATER DATUM: EL 576.8

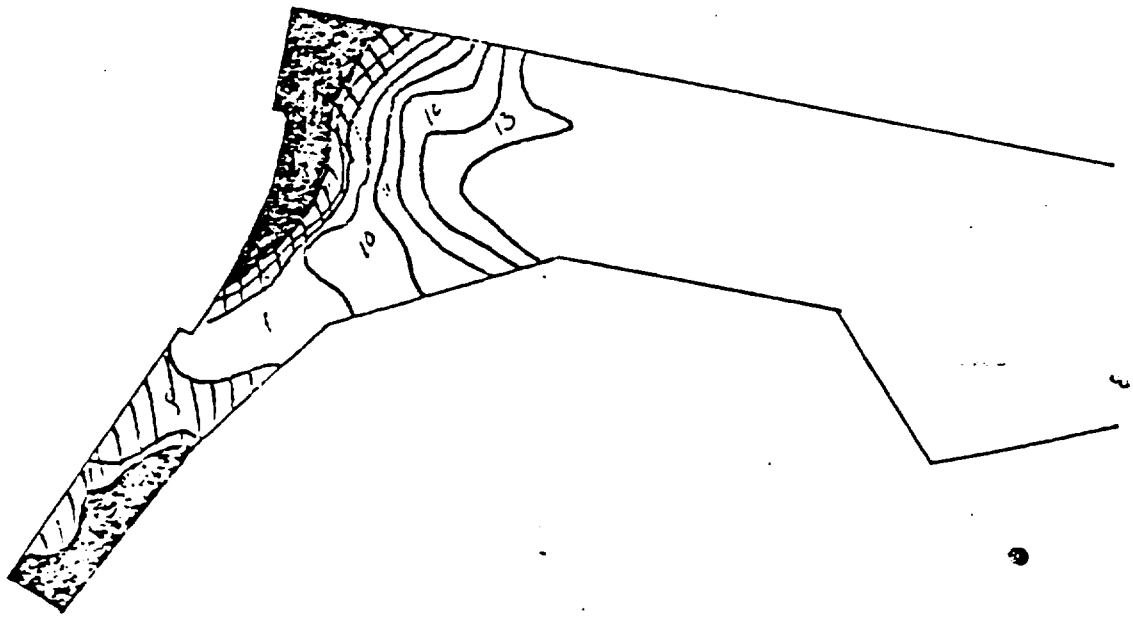


FIG. 2

WAUKEGAN HARBOR SLIP # 3

DEPTH OF WATER ABOVE ROCK LAYER : PRESENT CONDITION

WATER SURFACE ELEVATION @ HISTORICAL MINIMUM LAKE LEVELS (573.35')

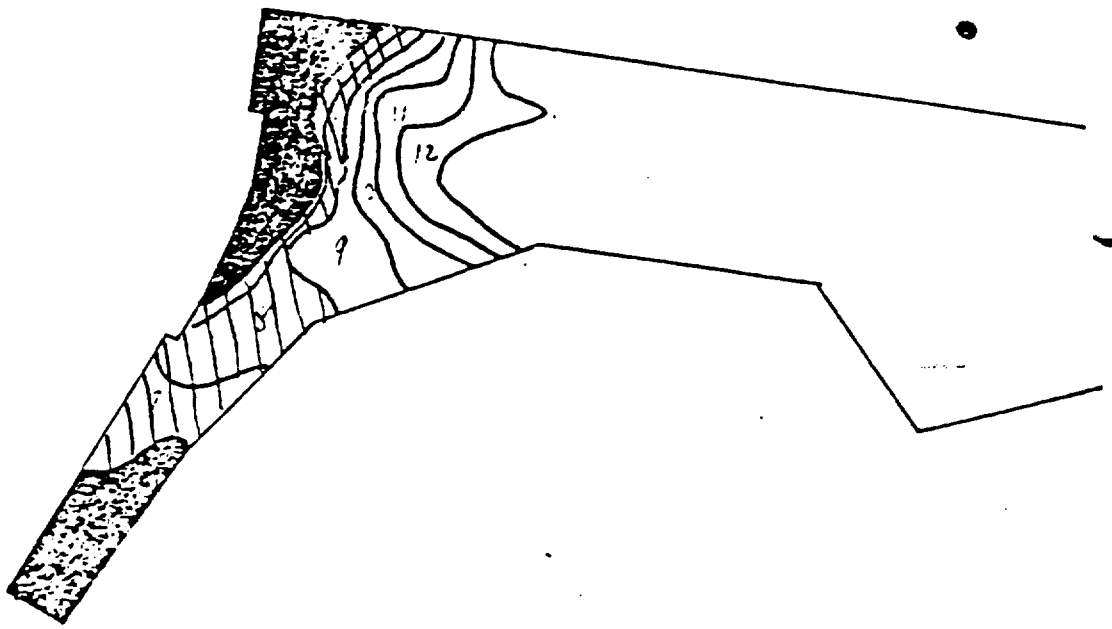


FIG 4

WINDSOR HARBOR SLIP # 3

DEPTH OF WATER ABOVE MUCK LAYER : FUTURE CONDITION:

WATER SURFACE ELEVATION @ HISTORICAL MINIMUM LAKE LEVEL (575.35)

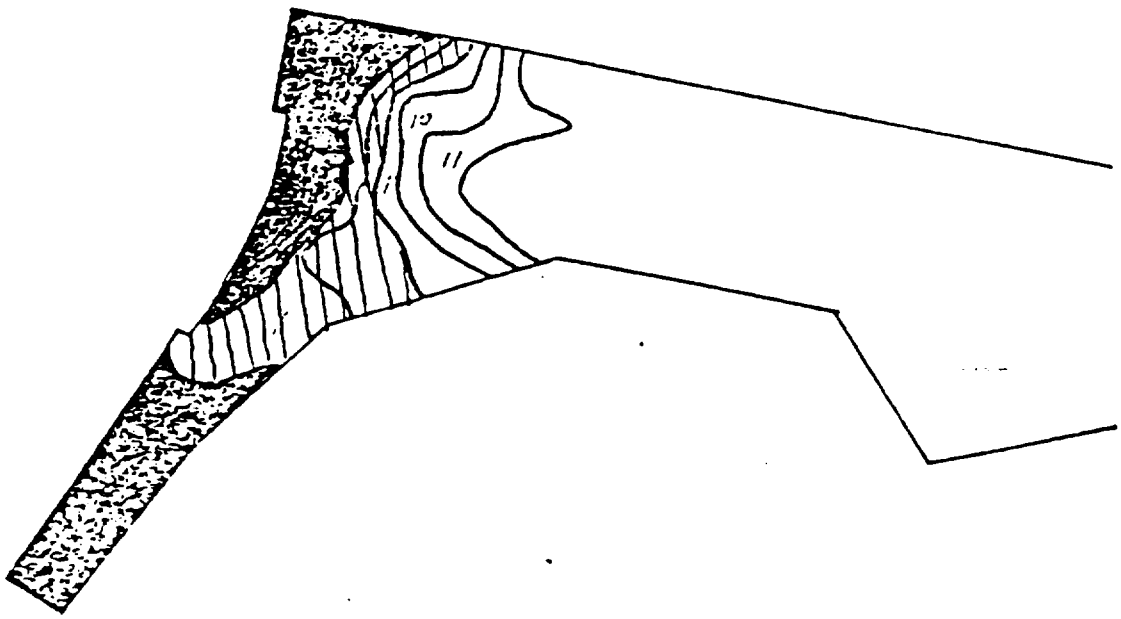


FIG 5

UNITED STATES — GREAT LAKES

HYDROGRAPH OF MONTHLY MEAN LEVELS OF THE GREAT LAKES

ELEVATIONS IN FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (1955)

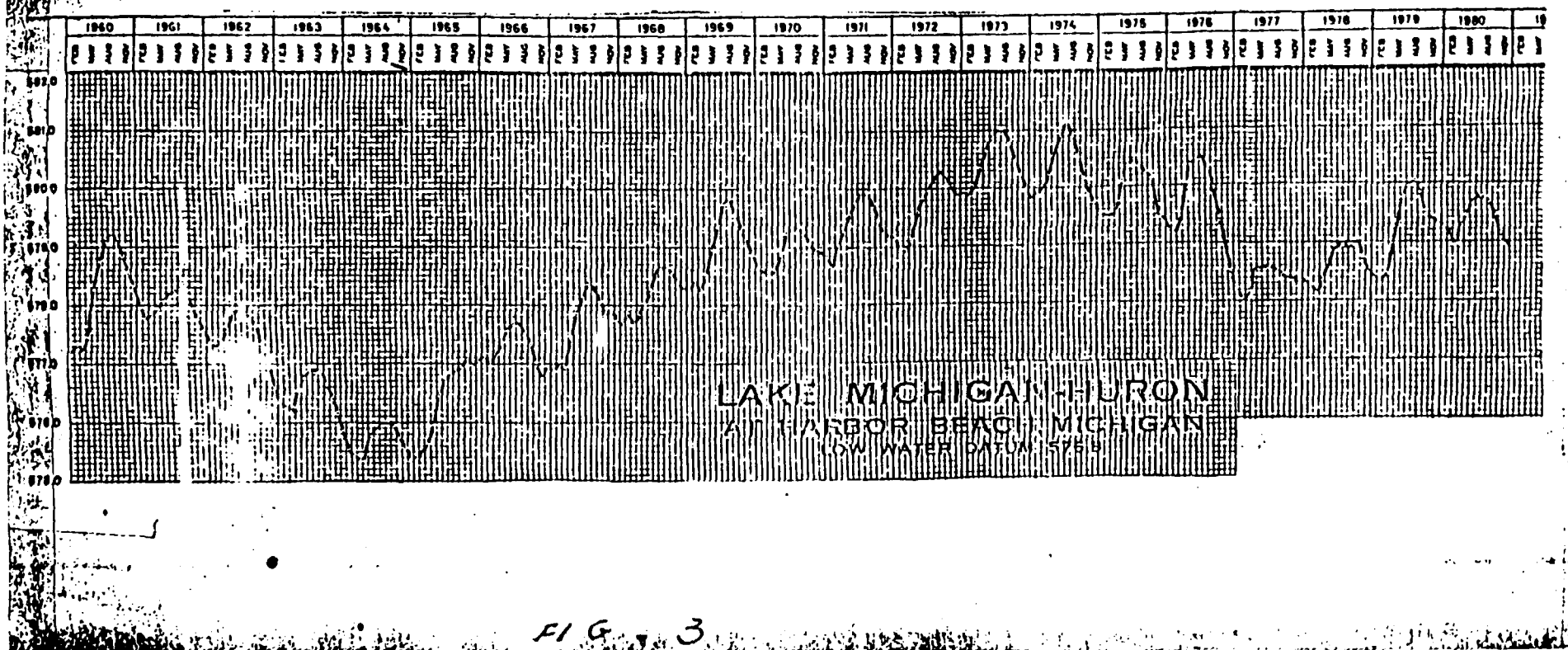


FIG. 3

MALCOLM PIRNIE

INTER-OFFICE CORRESPONDENCE

To: JC Henningson

Date: 8/6/32

From: MJ Mann/SA Roberts

Subject: Waukegan North Ditch

1. To prepare for testimony on PCB remedial actions on Waukegan, we were asked to look at three aspects of the situation. Those were:

   a. Do previous estimates for surface water discharge from the North Ditch to the lake consider only sediment transport or do they include a soluble component as well?

   b. Does the soluble PCB adsorb and then settle?

   c. What is the estimated effect of filling the North Ditch?

2. The following reports were reviewed:

   - EPA Overview Report
   - Draft EIS dated November 4, 1981
   - Math Modeling Estimate of Environmental Exposure Due to PCB-Contaminated Harbor Sediments of Waukegan Harbor and North Ditch, prepared by HydroQual dated February 1981
   - An Engineering Study for the Removal and Disposition of PCB Contamination in the Waukegan Harbor and North Ditch, prepared by Mason-Hanger dated January 1981
   - Hydrological Study of Groundwater, JRB Associates dated February 10, 1981.

3. After perusing the reports, it was found that the HydroQual report does consider the dissolved and particulate components of the total PCB discharge in both the Harbor and North Ditch areas. (page 42)

   The relationship between particulate and dissolved portions is shown by:

   $$C_D = C_T \left(\frac{1}{1 + am} \right)$$ ..... p. 44-45 of HydroQual

   where C_D = Dissolved PCB (ug/l)
   C_T = Total PCB (ug/l)
   m = SS (g/l)
   a = Partion coefficient. Used as 50-500 ug/g per ug/l based on Hudson River studies by Hydroscience.

   Running this through we find that the C_D may range from 2-173 based on a nominal ditch SS concentration of 100 mg/l.

Thus, based on HydroQual's estimate of 5kg per year of PCB discharged through the North Ditch to the lake, we may expect a maximum of 1kg to represent the dissolved PCB portion.

The dissolved portion is being discharged through two major mechanisms: solubilization of material in the ditch by surface waters and groundwater discharge through the ditch of solubilized material. We cannot estimate that split at this time.

The JRB report (p.65-70) indicated that at times (Type I Flow) the groundwater contaminated from the western enclave flows directly to the North Ditch. However, the extent and total loading on an annual basis have not been estimated.

4. The solubilized PCB will adsorb on appropriate sites down to solubility concentrations for the specific brand of Archlor. However, there are some important variables that modify this function. These were pointed out by SA Roberts memo of 7/21/82. PCB's are infinitely soluble in hydrocarbon and chlorinated solvents and "desorb" completely in the presence of non-polar solvents. There is some evidence that such solvents may be present on the site. Also, it is known that PCBs can move in ground water while adsorbed onto colloidal material.

5. Summary of North Ditch Discharge Estimates

Component	Mason-Hanger Final Report	HydroQual	JRB	Draft EIS	EPA Overview
Sediment	1-10 lb/yr	4 Kg/yr (8.8 lb/yr)	Ground water only	Appendix C not available	
Soluble	4 lb/yr (Base + Cooling water)[a] +6 lb/yr (storm flow)	1 Kg/yr (2.2 lb/yr)			
NET	11-20 lb/yr	11 lb/yr[b]	-	-	7-8 lb/yr[c]

(a) Ave ditch flow = 100,000 gpd
OMC cooling water flow = 150,000 gpd
Ave conc = 5-8 ppb

(b) Ave ditch conc Total PCB = 9.25 ppb

(c) EPA states "there is the possibility that, under special conditions, large additional releases may occur."

6. The big question coming out of this discussion is "will the filling of the North Ditch actually make the problem worse in terms of total PCB material discharged to the lake?"

Our conclusion is that, no, the situation will not be worse in terms of total PCB release. This is supported by the facts that:

a. Three phases can be expected in the overall equilibration of the discharge area. Phase 1: 0-30 year time frame. This period is from the filling of the ditch up until the first expected impact of the eastern enclave. Phase 2: 30-100 year time frame will see the complete migration and end of the eastern enclave. Phase 3: 300-500 year, the western enclave will reach the lake and eventually diffuse. This is based on the JRB work using Darcy velocity modelling neglecting porosity. (Draft EIS p. 1-27)

b. Particulate material discharged from the ditch will cease. For the next 30 years, (until the eastern enclave migration intersects the lake) PCB material release will be negligible.

c. The installation of a properly designed storm water interceptor will minimize ground water recharge and should slow the horizontal migration component.

d. Paving of the entire area will also minimize this recharge.

e. Adsorption will occur in the area between the eastern and western enclaves of PCB concentration, acting to mitigate overall discharges. This does not occur when contaminated groundwater flows directly into the North Ditch.

The major question is the net impact of the modification of groundwater flow directions within the area. However, we have calculated that even if the western enclave would contribute to the direct discharge the total quantity would not exceed 5kg. This estimate assumes no adsorption through the site. The calculations are summarized in 7.

7. PCB Loading Rates from the western enclave after filling North Ditch

The ground-water discharge was first calculated, using the Darcy Equation:

$$Q = KIA$$

- K = hydraulic conductivity; two values were used:
  - 1×10^{-3} cm/sec - slower rate
  - 6×10^{-3} cm/sec - faster rate

These values are taken from the JRB report (p. 3-42); they represent the upper and lower limits on the mean baildown permeabilities, calculated from field measurements.

- I = hydraulic gradient; a value of 0.001 ft/ft was used; this is a typical value for a low gradient and is similar to values calculated from actual head values on-site.

- A = cross-sectional area; the values used were:

    - 1000 ft. - width of aquifer from ditch to middle of parking lot (assumed to be topographic high)
    - 25 ft. - depth to silt layer, based on values in JRB report (p. 3-24)

$Q(slow) = 71\ ft^3/day$

$Q(fast) = 425\ ft^3/day$

(conversion factor used = 2835.36)

The PCB loading rates were then calculated using a PCB ground-water concentration of 1000 ug/l. This is taken from the maximum PCB concentration that appears to be at least somewhat mobile in the aquifer. The loading rate was calculated using the following equation.

PCB concentration (g/l) x 0.062427 (conversion factor) x Q (cfd) = PCB lbs/day

Low PCB loading = 1.8 grams/day or 0.004 lbs/day
High PCB loading = 13.6 grams/day or 0.03 lbs/day

The limitations of available data preclude establishing the extent of time when flow is toward the lake and therefore an estimate of annual loadings from the western enclave is not possible at this time.